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ABSTRACT

This book explains how computers can be used in the home, office or school, and provides a consumer's guide to computer equipment for the novice user. The first sections of the book offer a brief sketch of computer history, a listing of entertaining and easily available computer programs, a step-by-step guide to buying a computer, and advice on how to use computers for business applications. Additional chapters give detailed explanations of how computers work, the more popular computers on the market, common computer programming languages, and places for locating computer software and hardware peripherals. A list of bibliographies and directories, book publishers, and magazines is provided to assist the novice computer user to expand upon the fundamental background presented in this text. (MER)

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Computers For Everybody

Jerry Willis and Merl Miller

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DEDICATION

When we decided to write this book, we started by defining our typical reader. We both wanted to keep someone in mind while we wrote the book, so that we could have a standard to judge it by. We wanted an intelligent adult with little or no technical background. We both chose our mother. This is our way of saying "Thanks, Mom, for helping with this project and lots of others you didn't know about either."

Dedicated to:

Lavice Willis
and
Margaret Miller

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Chapter 1

How To Impress Your Friends and Wow Your Local Computer Dealers

By the time you finish reading this page you will be able to do something that 95% of the people can't do. You will be able to program a computer. By the time you finish reading this book you should know enough about computers to select one that is appropriate to your needs, and you'll know which of your needs a computer can fulfill. We hope this book will entertain, amuse, and enlighten you about small computers.

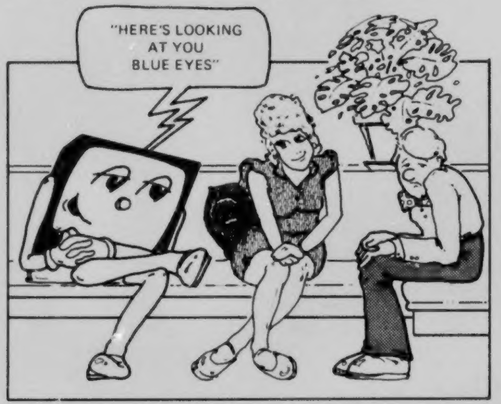
Not so sure you'll be able to program a computer by the end of the page? Have faith. Let's look at a simple program you can run on one of the computers displayed at your local computer store. Here's the program:

```
100 LET A=2
200 LET B=3
300 LET C=A+B
400 PRINT C
```

When you get to the store you can "load" this program into the computer just by typing it in on the keyboard (ask the dealer to turn the machine on for you and tell him you would like to run a short program). Type the program in exactly as shown above. When you get to the end of each line press the RETURN key (some computers will have an ENTER key). If you make a mistake just press RETURN and type the line over again. When all four lines are typed correctly, type RUN and hit the RETURN key. The computer will respond with "5". Isn't that marvelous!

By now you are probably saying to yourself, "Well, big deal! I can add 2 plus 3 on my $4.95 calculator and come up with 5. In fact, if it's a good day I can probably do it in my head and come close to the right answer. I haven't learned anything." Oh, but you have though. You've learned that there isn't anything frightening or magical about computers, and that's a very important lesson.

One of the biggest problems most people face in dealing with computers is fear. We've been taught to think of computers as big, complicated machines that, in the wrong hands, can do terrible things. We've been told for many years that the reason the bill was wrong was because the computer made a mistake. In reality, what happened is that a person made a mistake. The computer is just like any other machine or tool. It is only as good as the person who runs it and only as useful as a person makes it. You can choose to use it in any manner you want. It won't take over your life, run off with your wife, or report you to the IRS. It does only what you tell it to do.


"HERE'S LOOKING AT YOU BLUE EYES"

A person who doesn't want to learn anything beyond how to load a program into the machine and run it doesn't have to. You don't need to know how to program in a "computer language." There are thousands of "canned" programs available, covering a wide variety of subjects. Here are a few examples:

Educational Programs. These programs can teach a grade schooler how to do fractions or an adult how to read faster.

Personal Enrichment. You can chart your biorhythms or play the stock market.

Game Programs. You can zap invaders from space with your laser ray or play chess.

Business Programs. There are programs for inventory control, accounts receivable, word processing, and much more.

Arts Programs. You can paint abstract pictures on a video canvas or create the great American opera with a computer-controlled composing program.

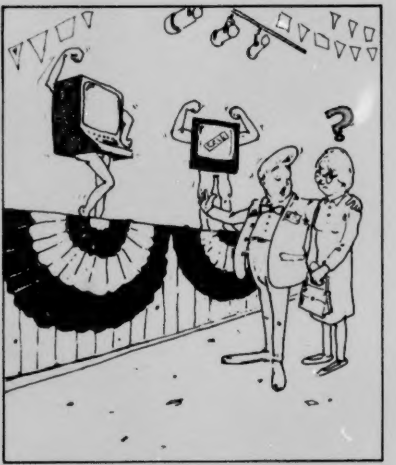
These five areas as well as many others will be discussed in detail in the following chapters. Remember, a computer is a tool. How you use this fantastic tool is up to you.

A computer has a lot of flexibility. It will do the same things a calculator will do (e.g. balance your checkbook), and it will do many more routine clerical jobs such as keeping track of Aunt Edna's birthday. It will also do some very innovative jobs. For example, one of the most innovative programs we've heard about is one that keeps track of a three-year-old diabetic. It tells his parents when they should give him his insulin, what his reaction to the insulin is, and how he is doing in general. The computer not only displays his current vital signs numerically, but also creates a graph which shows the trend across several days and weeks. The important thing about all this is that the child's parents are just ordinary folks like you and me. Neither parent has any medical background or college training in computers. They bought their computer and taught themselves enough to create a modern miracle for their son. Take a minute to think about it. How could you use a computer to improve your life?

Perhaps you want to use a computer in a small business. Thousands are doing it every day and the cost is less than you might think. It no longer costs $20,000 or more to buy a small business computer system. Some businesses actually do quite a bit of work with systems that cost less than $2,000. They won't keep track of ITT's cash flow, but they will do many jobs very nicely.

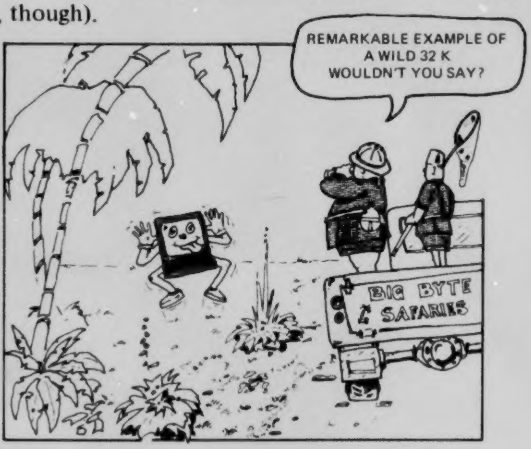
O.K., so now you're interested. Where do we go from here? A good starting place is a local computer store. A lot of places sell small computers today. Try your local Radio Shack dealer, for example. The TRS-80 computer manufactured by Radio Shack is one of the most popular small computers in use today. You can buy one for the cost of a good color television.

Whether you go to Radio Shack or some other computer outlet or a department store, you will probably encounter one of two problems. The salesperson will either know too much or too little. There are very few people around who can tell you just what you need to know. It is quite possible to end up with a salesperson who knows less about computers than you do, especially in a store where computers are a small and perhaps unimportant sideline. To an appliance or stereo salesman the computer may be just another machine like a dishwasher, dryer, or range (Yes ma'am, would you like one in coppertone or jungle green?). In all fairness though, the salesperson may be the same kind of informed consumer you want to be. In fact, he or she may even own a computer. You'll just have to learn as much as you can, and be prepared.



The retail computer store was one of the most exciting new businesses of the seventies. You will meet real experts there. They may not, however, be able to talk to you on a level you understand. Most computer stores were started by computer hobbyists—another word for a fanatic when it comes to computers. Many such hobbyists can't understand why anyone would not want to learn everything there is to know about computers. To the devout there is no middle ground. If you like computers, you REALLY like them. It's hard for the hobbyist to understand that some people just want to use the computer as a tool , not adopt it into the family.

This is not to say that a computer store isn't a good place to buy a computer, because it is. Some of them just take a little effort. The remainder of this book will help you deal with the problems of buying a computer. Be prepared, for instance, to experience some confusion when you go into a computer store. The technical jargon there may be wall-to-wall; terms like RAM and ROM, PASCAL and BASIC, DOS and DISK may abound. You'll find out what the most important terms mean as you read this book, so hang in there. In fact, we urge beginners to read this book all the way through before making that first serious computer-buying safari (short sorties and patrols are O.K., though).


REMARKABLE EXAMPLE OF A WILD 32 K WOULDN'T YOU SAY?
BIG BYTE SAFARIES

The rest of this book is written and organized so a reader can skip around. You can understand chapters at the end of the book without reading every chapter that came before them. Chapter 2, Sixty Things You Can Do With Your Computer, is a fast-paced introduction to the various applications of computers. Typical uses range from one job or "dedicated" functions such as controlling home security systems to more diverse applications in a small business, in education, and at home. In Chapter 2 you will see some "canned" or off-the-shelf computer programs that are for sale now.

If you're thinking of buying a computer for use in your home, Chapter 3, A Computer for Your Home, will walk you through the steps involved. It covers such topics as intended applications, features to look for, and typical cost of systems. It also discusses service and how to get it. Finally, Chapter 3 discusses software for the home computer.

Small computers can earn their keep in businesses too. A system in your small business can save money, enhance operational efficiency, and save time. If a computer can save money, you're losing money by not having one. A small businessperson must constantly make decisions, and effective decisions depend on the constant flow of fresh, relevant information, concisely presented. Could a small computer help you with those decisions, with your accounting, with inventory control, with other problems? You'll find out in Chapter 4, A Computer for Your New Business, Old Business, or Monkey Business.

Since most people work for someone else, Chapter 5, Help Yourself – The Professional's Computer, talks about how to use a computer in your profession. A small computer can help calculate sales or cash flow projections for a client; it can keep track of client accounts; it can help write books or articles, and it can help people in hundreds of professions do their work more effectively.

Because we feel readers may want (and need) to know something about how computers work we have included Chapter 6, It's Not Magic: The Basic Computer. It is a brief nontechnical look inside the computer. We will explain terms like CPU, ROM, RAM, and other "computer jargon." (Then you should be able to steer the computer store salespeople into discussions you understand.) We will talk about input, output, processing, and memory. As you will see in Chapter 6, a computer is a relatively simple device.

In Chapter 7, The Current Crop, there is a description of all the major new small computers on the market. All the "old favorites" still in production are also described. We will give you our opinion as to what is good and what is bad about all these systems. Chapter 7 will also give you a chance to practice the computer-shopping strategy suggested in Chapters 3 and 4.

You buy a computer because it will do a job. It takes software to make the computer do useful work. Software is explained in Chapter 8, The Stuff That Makes It All Happen – Software. If you're saying, "Software, what's that?" an analogy might help. If this were a book on cooking, the stove, mixer, and microwave oven would be kitchen hardware. The "software" would be recipes – directions telling you which ingredients to mix and how to cook each dish. With a computer, the software is the set of directions it follows as it does a job. Chapter 8 provides a brief explanation of what computer software is and how you can use it. This chapter also talks about computer languages such as BASIC, FORTRAN, and PASCAL.

Chapter 9, Some Nice Things You Should Have, covers the basic accessories that almost every computer must have in order to function. We discuss items such as monitors, recorders, and memory. We not only describe these devices, but we also give some suggestions on what you need, what you will want, and what you can do without. In addition, there is an in-depth discussion of printers – from dot matrix to daisy wheels, old war surplus to brand new technologies, "hobby" quality to word processor quality.

Once you are really hooked on small computers, you're ready for Chapter 10, How to Make Your Computer Sit Up and Sing. This chapter describes most of the "extras" you may want such as disk systems, expansion boards, color graphics, music and voice synthesizers, light pens, and modems.

We have tried to pack this book with solid, useful information but, by no stretch of the imagination, is it comprehensive. There are too many things to know and too many developments in this fast-moving field. This book is a good introduction, a beginning. It will provide a firm foundation. After reading it you can pursue your own areas of interest. Chapter 11, Where to Find Everything We Didn't Tell You, will help in that respect. It describes and evaluates the computer magazines available today, identifies their intended audience, and provides subscription information. Finally, the chapter gives information on some of the many book publishers, user-group newsletters, software publications, and periodicals oriented to a particular computer.

Before you go blazing off into your favorite chapter, let us tell you about something that interests us. Neither of us could be legitimately called computer hobbyists; we are more like computer aficionados. We hope that *Computers for Everybody* will be your first step in becoming a computer user and perhaps a computer aficionado too. With that in mind, you might be interested in how computers came about. This section won't help you buy or use your computer, but we hope you will find it interesting.

"Since the turn of the century, only a handful of significant developments have directly affected the everyday lives of all of us – the electric light bulb, telephone, automobile, radio, television and most recently, the electronic digital computer, whose impact may be the most encompassing and dramatic of all." This comment sort of sums it up. It is the introductory sentence from Herman Lukoff's *From Dits to Bits. . .A Personal History of the Electronic Computer.* If you are really interested in the development of the modern-day computer you should read Mr. Lukoff's book. Here, we will limit our sketch of computer history to only the most recent developements.

The computer was developed at the University of Pennsylvania during World War II. The initial idea was to develop a device that could both determine missile trajectories and predict the weather. Within a few years the machine was being used for a variety of business and government applications. By 1952 it was predicting election outcomes, and a new company, International Business Machines, had entered the field. We don't need to tell you the effect IBM had on the beginning computer business, but we are getting ahead of ourselves. A lot of things helped bring about the modern personal computer. The first of these was the transistor.

The invention of the transistor in 1948 made modern computers practical because of their dependability, small size, and low power requirements. Transistors quickly replaced vacuum tubes as the building blocks of computers, and the computer age was underway. Since then several major advances in semiconductor technology have produced smaller and smaller components that did more and more. In the late 1950's and early 60's the integrated circuit or IC was developed. An IC contains several transistors, resistors, and capacitors in a circuit that is enclosed in a single small case. Large Scale Integrated (LSI) circuits followed soon afterward with hundreds, then thousands of components packed into a single chip. It may be somewhat misleading to say that there are "components" inside an IC. Actually there is generally one wafer of material such as silicon on which several different layers of other types of material have been deposited. The pattern of these layers creates the effect of transistors, resistors, and capacitors without the necessity of manufacuring individual components and then installing them in a circuit.

In 1970 the first microprocessor chip was produced. These "computers on a chip" are what made personal computers possible. A single chip today contains the same amount of computing power that took tons of equipment twenty years ago. One early computer ENIAC, occupied 3,000 cubic feet of space, took 140,000 watts of power, weighed 30 tons, and had 18,000 tubes, 70,000 resistors and 10,000 capacitors. Today the KIM microcomputer from Commodore weighs about a pound and can be held in your hand. Yet it is more powerful than ENIAC and does its work much faster. The KIM is also about 10,000 times more reliable and costs less than a good set of snow tires.

Since the fifties computers have steadily become smaller and cheaper, and this pattern has produced a corresponding change in the type of people who use them. Early computers were within the financial reach of only a few large companies, universities, and government agencies such as the military. But as the price decreased computers became more cost effective for more and more companies, especially those with large amounts of routine numerical operations to be done. Almost every bank today, for example, uses a computer to maintain accounts. As the technology of producing semiconductor integrated circuits advanced, a new type of computer–the minicomputer–emerged. Instead of occupying entire rooms like the giants of

COMPUTER
HERE

IBM, the mini is more the size of a color television. Digital Equipment Corporation sold thousands of their PDP-8 minicomputer to businesses that do not need a larger computer. Steel fabricators, for example, developed programs for the PDP-8 that allowed them to precisely control the steel-making process by computer. Scientists used minis to control experiments in the laboratory without tying up a large computer, and trucking companies used them to arrange routings, compute charges, and do the paperwork.

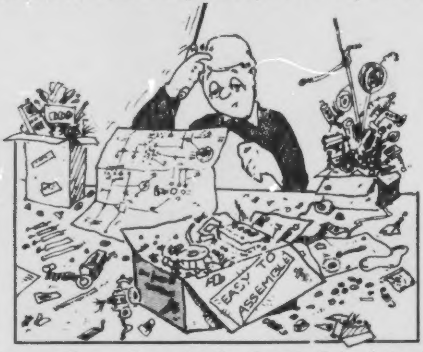
The minicomputer brought the power of the computer to small businesses, but not to individuals. Although the cost of a mini has dropped considerably in the past few years, a typical business system still costs over $20,000, much more than the average individual can afford to invest. Digital Equipment Corporation's first PDP-5 cost $30,000 in 1963, and the PDP-8 was $18,000 when it was introduced in 1965. In 1970 the PDP-8 was still in the $10,000 range for a basic system.

An honest-to-goodness computer revolution occurred in 1971, however, when Intel Corporation produced the first microprocessor or "computer on a chip," the 4004. It was a crude, expensive device that was used primarily in commercial settings. In 1972 Intel produced the 8008, a more sophisticated microprocessor that was cheap enough to be attractive to individuals interested in computers. Its use was limited, however, by a shortage of the support chips needed to create a working 8008 computer system and by the fact that few people knew exactly what to do with a "computer on a chip." Intel marketed the 8080 chip in 1973, and it has become the foundation for a whole new industry–personal computing. Although it cost several hundred dollars in 1974 and was hard to find, the 8080 can be ordered by mail today for well under $20. Its position of preeminence, however, is being challenged by other chips such as the Z-80 from Zilog and Intel's own 8085 and 8088.

At about the same time Intel was busy creating microcomputer hardware, another important ingredient in the personal computing movement was emerging. Hardware, the actual computer and its accessories, is only half a computer system. To get it to do anything useful the computer must be given a set of instructions that tell it exactly what to do. These instructions are called programs or software, and they are at least as important as the nuts and bolts of a system. Until the early seventies not many programs existed that would be of interest to the individual computer user. Few of us, for example, need to know where a 60mm shell would land if fired from a particular artillery piece at a 30 degree angle in a ten-mile-an-hour crosswind, nor do we have a use for a program that will calculate the load capacity of a 30-foot steel beam. In the early days of computing the instructions (or software) were written in a way that was easy for computers to understand but not so easy for people. Programming was thus a specialized task that required sophisticated training. In 1973, however, a simple computer language called BASIC, Beginners All-purpose Symbolic Instruction Code, was developed by John Kemeny and Thomas Kurtz at Dartmouth College. BASIC is the tourist's Spanish of computer languages. It is easy to learn, yet is a powerful way of talking to the computer in a language that is similar to English. The creation of BASIC made computers easily accessible to thousands of people who had no previous contact with them. People like Bob Albrecht, then with Digital Equipment Corporation (DEC) spread the gospel of BASIC through workshops, introductory books, and general enthusiasm. David Ahl, another DEC employee, was also a preacher of the BASIC gospel. Between them Ahl and Albrecht helped to create a collection of recreational programs written in BASIC that made computers available to thousands. Believers then taught others how to use minicomputers to play games, draw pictures, and provide instruction. Albrecht, Ahl, and their followers are still in the forefront of the personal computing movement. The People's Computer Company, a nonprofit group founded by Albrecht, now publishes several magazines for the individual interested in computers. Ahl also published *101 BASIC Computer Games* in 1973. It is still available and highly recommended for those who are even slightly interested in the recreational side of computers.

Although Ahl and Albrecht were excited about the personal computing market their employer, DEC, had about as much as it could handle from its traditional customers and made little effort to move into the new field. DEC support for BASIC, however, and its encouragement of the development of recreational uses of minicomputers helped create a small army of informed customers who wanted more – and at a price they could afford.

In 1974 the market created by Ahl, Albrecht, and others was tapped. Several groups offered computer kits that could be assembled by users. The result was an inexpensive microcomputer system that, at least theoretically, would do many of the things the PDP-8 minicomputer would do. By taking advantage of technological advances in large scale integration these companies were able to build a working computer that was about the same size as a home stereo system. The best known of these early kits was the Mark-8 which used an Intel 8008 microprocessor chip. Over 1200 people ordered the Mark-8 kit after it was described in a 1974 *Popular Electronics* article. The kits offered during that time were financial failures. Assembling and operating one of these early kits still required a fair level of sophistication in electronics and computer logic to make them work. These qualifications severely limited the market for the first microprocessor kits. They were, however, the leading edge.



The market and product both changed in late 1974 when an obscure company with the unlikely name of Micro Instrumentation and Telemetry Systems (MITS) produced its first microcomputer. MITS was founded in 1969 by H. Edward Roberts to produce electronic systems for model rocketeers. With about $10,000 in equipment and a $400 investment by four partners, Roberts moved from model rockets to calculators and began selling a low-cost programmable calculator in 1971 for $199. Comparable units from Hewlett Packard cost $6,000. Their success in the calculator market led MITS into the handheld calculator field at a time when the giants like Texas Instruments were about to settle down to a serious price war. MITS was an early casualty in that war and borrowed heavily to avoid closing down permanently. Roberts decided his next venture would be in the personal computing market, and in 1974 a MITS microcomputer kit was featured on the cover of *Popular Electronics*. Although some employees had suggested names like "Little Brother," Leslie Solomon, the technical editor of *Popular Electronics*, convinced Roberts to consider another name. Solomon's daughter suggested the name Altair. (She got it from the television program Star Trek.) The name stuck and orders rolled in. MITS expected 800 orders in 1975; they shipped 1500 units in the first two months at $398 each.

The Altair was the first commercially successful microcomputer, but as demands for it increased, the time between placing an order and receiving your kit also increased. These long delays at MITS created a place for several other companies like IMSAI, Southwest Technical Products Corporation, Processor Technology, and Digital Group. Between 1975 and 1977 these companies also began offering microcomputers and accessories to a growing market which grew to include people from nearly all walks of life. Competition since 1974 has been tough and with the exception of Southwest all of these pioneering companies are gone now.

Although some people have referred to microcomputers and their use by individuals as a "hobby," the fact is that most people who buy a micro have some idea in the back of their head about using it in their profession, their business, schoolwork, or in some consumer-related project. We prefer to use the term "personal" rather than hobby in referring to the use of micros by individuals. Personal computing is the use of a small computer by an individual, small group, or family for recreational, business, or personal purposes.

The computers offered by MITS, Altair, Processor Technology and others can be considered second-generation machines with the Mark-8 being first generation. The Altairs and their competitors were available in assembled as well as kit form, had BASIC as standard software, and could be attached to a variety of accessories (e.g. typewriters, televisions) with only a few technical adaptations. These second-generation machines were still being refined and improved when a third generation emerged. During 1977-78 several large manufacturers brought mass merchandising to personal computing. Radio Shack, Commodore – the calculator company, and Apple, all offered third-generation microcomputers designed specifically for the beginner in personal computing who had neither the electronics background nor the knowledge of computers that characterized many of those who bought second-generation systems. These computers all come assembled and have been designed so that the user can unpack a system, plug it in, and begin operating immediately. BASIC is usually "built in" so that the operator can use English-like words to talk to the computer. The third-generation computer is not so much an improvement over second-generation systems as it is a change in design emphasis. They are like the self-contained stereo systems you can buy at Sears or K-Mart. With the combination radio, tape player, and automatic record changer all in one unit, and mass produced, they are both reasonably priced and of relatively good quality. But there is a price to be paid for all that convenience. Many of us never outgrow the stereo we bought at Sears. The audio purists, however, are more likely to have a component system made up of equipment from companies like TEAC, AKAI, and SANSUI. Companies like these cater to the finer tastes of the initiated, and provide their owners with a quality and versatility not usually obtained with mass market systems. It appears that the same situation is rapidly evolving in the personal computer market.

Chapter 2

Sixty Things You Can Do With Your Computer. . . . Right Now

A computer is a box filled with plastic and silicon. It has no utility until you put some software in it. In this chapter we will show you some things you can do with your computer. We could say "It will do this and that," but we think you will find our way more interesting. This chapter is devoted to a group of programs that will operate on most computers. These programs are real! They are produced by reputable companies, and are available today. They are not hypothetical ideas about what a computer can do.

The programs are broken down in to four major areas: Personal,Educational, Business, and Professional. We will explain each area as we go. Following each description is a reference code. The first item (1) shows the publisher. A listing of publishers is shown on page 171. They are grouped alphabetically. The next item (2) shows all the computers on which the program will run. Last, but probably not least, is the price (3). Software in this chapter costs from a low of $3 (for some of the personal software) to a high of several hundred dollars (for some of the business software). To give you an idea of the general cost of each program we have divided prices into these categories:

$A – under $10.00
$B – $10.00 to $25.00
$C – $25.00 to $100.00
$D – more than $100.00

When we prepared this chapter, we evaluated over 200 programs. There are several thousand more that we didn't cover. The programs we settled on were selected for their generality or interest level only.

PERSONAL

The programs in this section are primarily aimed at improving your life. There are some games, and there are some programs that will make you think.

Checkbook

This program takes you through the necessary steps to balance your checkbook. It starts off by giving you instructions about how to verify that the amount of each check and each deposit are the same on the statement as they are in your checkbook. Then it asks for the ending balance shown on the bank statement. It continues to ask questions until you have entered sufficient information. Best of all, it never forgets. [(1) DP; (2) TRS-80, Apple, Exidy, PET; (3) $A]

Personal Finance

Let your computer handle all the tedious details the next time you figure your finances. You can control your incoming and outgoing expenses. In addition the computer will balance your checkbook and keep a detailed list of expenses for tax purposes. (IS; TRS-80; $A)

Mileage

This program will help you keep track of gasoline consumption, miles driven, and MPG for your car. A running log of all information is maintained. (DP; TRS-80, Apple ,Exidy, PET; $A)

Biorhythm

Did you ever have one of those days when nothing seemed to go right? Biorhythm theory says that all of us have cycles that influence physical, emotional, and intellectual status. This program will compute yours. It may not be scientifically valid but it's fun. (DP; TRS-80, Apple ,Exidy, PET; $A)

Personal Bill Paying

How many times have you thrashed around with your bills, trying to figure out what to pay to whom and when? This program can help. It will set up 22 accounts and keep track of the history of those accounts. (IS; TRS-80; $A)

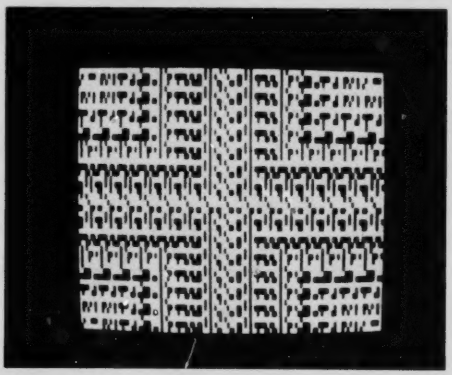
SO...
LATE AGAIN
PAYING MY
INSTALLMENT!

VitaFacts

The six topics which make up the VitaFacts series provide a health education experience for you and your family. Physician-approved, VitaFacts uses a combination of computer and audio cassettes to present dramatic vignettes and straight talk, enhanced by computer reinforcement along the way. Topics included are: Growing Up, Talking About Sex, Drinking and Drugs, Birth Control, Your Blood Pressure and Heart Attack. (PS; Apple, PET, TRS-80; $B)

Kaleido

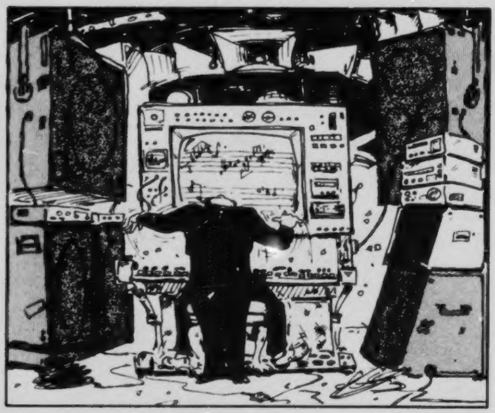
On the following page you will see a typical pattern generated by Kaleido. This program creates a series of kaleidoscope-like designs, with each one overlapping the previous one. (DP; Apple, PET, TRS-80, Exidy; $A)



Kaliedo

Keynote

Hear any type of music in slow, medium, or fast tempo. Input music, review and edit the music, and play it. (HY; TRS-80; $A)

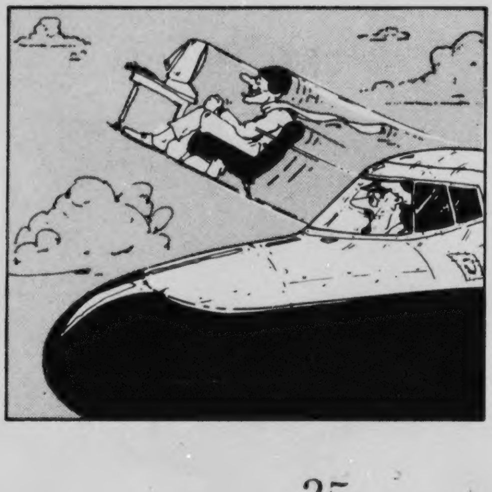


Sketchmode

With this program you can create computer graphics displays. Freehand drawing capability is also included. (HY; TRS-80; $B)

Microcomputer Flight Simulator

This is *not* a game. This realistic simulation allows you to take off, fly, navigate, and land an airplane. (DC; PET; $B)



Typing Tutor

Does the "hunt and peck" method of typing slow you down? Typing Tutor is for everyone but the most advanced typist. The program keeps track of the keys you know, the keys you are learning and the keys you don't know. The computer automatically tabulates your speed and accuracy and gives you appropriate practice exercises. (MS; TRS-80, Apple; $B)

Decode

Decode is really more of a puzzle than a game. Each time you play, you are presented with a new puzzle to solve. The object is to figure out the computer's secret code in as few guesses as possible. (DP; PET, TRS-80, Exidy, Apple; $A)

Bridge

This program is unique in its ability to challenge the experienced player and yet provide an entertaining and instructional introduction to contract bridge for the novice. It both bids and plays. (DC; PET, TRS-80, Apple, North Star; $B)

Blackjack

This program allows the computer to take the role of a smart blackjack dealer in a Las Vegas casino. One or more players can play "against the house" with the computer dealing hands, paying off (or collecting) bets, and keeping track of earnings. It's a realistic program. (RS; TRS-80; $A)

Jot

Jot is a one- or two-player word game involving considerable mental deduction. You can either play the computer or play a friend. Each player chooses a secret word and the other player tries to figure out what the word is. (DP; TRS-80, Apple, PET, Exidy, $A)

Sargon: A Computer Chess Program

You can play with black or white. You can either play against the computer or set up problems and observe how the computer deals with them. In either case the computer puts a chess board on the video display and, as moves are made, the board on the screen changes. (HY; TRS-80, Apple, $B)

EDUCATIONAL PROGRAMS

Education is an area where computers can be of great value. Although a computer will never replace the teacher, it can be a great aid in helping students learn. Programs in this section are primarily intended for children, but adults may find some of them both interesting and informative.

Arithmetic

These programs provide mathematical drills for grade school children. The student can request problems in addition, subtraction, or multiplication. The problems can be easy, medium, or hard. (DP; TRS-80, Apple, PET, Exidy; $A)

Metric

Using a quiz format, this program will familiarize you with the metric system. (DP; TRS-80, Apple, PET, Exidy; $A)

Math Tutor

Students can enjoy their math lessons with programs that play hangman, cast spells, and attack alien spacecraft. Success depends on the student's math ability. (IS; Apple, $A)

Video Speed Reading

Do you sometimes read the individual letters of words? Most people do. This program will help you learn to read phrases. (IS; TRS-80; $A)

Beginner's Russian

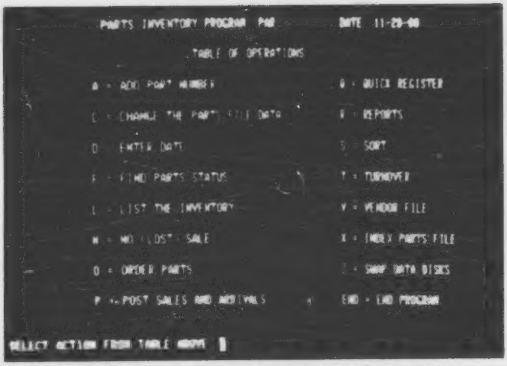
The three programs in this package will give you on-screen displays of the Cyrillic letters, detailed instructions on their proper pronunciation, and exercises that will help you recognize and speak simple Russian words. (IS; TRS-80; $A)

BUSINESS

If you use a computer in your business, will it make you rich and famous? Probably not, but it will help you run your business more efficiently. The programs in this section and those discussed in Chapters 4 and 5 were designed specifically for small businesses.

Inventory Control

If you are involved in selling parts, this program can be a lot of help. It will keep track of up to 3800 separate items. (DP; TRS-80, Apple; $A)



```
          PARTS INVENTORY PROGRAM PAR           DATE 11-29-80

                      TABLE OF OPERATIONS

     A = ADD PART NUMBER                    Q = QUICK REGISTER
     C = CHANGE THE PARTS FILE DATA         R = REPORTS
     D = ENTER DATA                         S = SORT
     F = FIND PARTS STATUS                  T = TURNOVER
     L = LIST THE INVENTORY                 V = VENDOR FILE
     N = NO LOST SALE                       X = INDEX PARTS FILE
     O = ORDER PARTS                        Z = SWAP DATA DISKS
     P = POST SALES AND ARRIVALS            END = END PROGRAM

SELECT ACTION FROM TABLE ABOVE █
```

Parts Inventory Program

General Ledger

This comprehensive applications package is suitable for multi-client CPA write-up and for individual partnerships, corporations, and sole proprietorships. (SSG; runs on most systems; $D)

Accounts Receivable

A complete open-item or balance-forward system, this program can operate alone, or interface with the General Ledger. It produces customer statements, aged trial balance, on-line account enquiry, and sales reports. (SSG; runs on most systems; $D)

Accounts Payable

This program is designed to produce aged statements of accounts quickly and easily, and to write checks in payment of desired invoices. It projects cash requirements, updates General Ledger and produces detailed check register. (SSG; runs on most systems; $D)

Loan

One of the most frustrating things about borrowing money is that it is difficult to evaluate all your options. This program will help. You can vary the basic information in any way you want and make an intelligent decision based on this information. (DP; TRS-80, Apple, Exidy, PET; $A)

Text Processing

This program lets you make multiple copies of any text. For example, you can run personalized form letters complete with name, address, and other insertions. (SS; runs on most machines; $D)

Bookkeeper I

This product was developed for small businesses. You don't have to know anything about computers or accounting to use this simple self-instructional package. (DTI; TRS-80; $C)

Business Package I

Keep the books for a small business with these six programs. General Information shows you how to use the package. Fixed Asset Control gives you a list of your fixed assets and term depreciation. Detail Input lets you create and control your general ledger. Month and Year to Date Merge gives you monthly and yearly updates to your general ledger. Profit and Loss computes your income statement and your trial balance. Year End Balance combines all of the data into a year end balance sheet. (IS; TRS-80; $C)

Accounting System

The programs in this package can be used separately or combined. General Ledger keeps a detailed record of all financial transactions, and generates the balance sheet and income statement. Accounts receivable is a complete invoicing and monthly statement generating package that keeps track of the current and aged accounts receivable. Accounts Payable keeps track of current and aged accounts payable and incorporates a check-writing feature. Payroll not only prepares the checks and makes the necessary accounting entries, but it also prepares tax forms. (PTS; runs on most systems; $D)

Micromed and Microdent

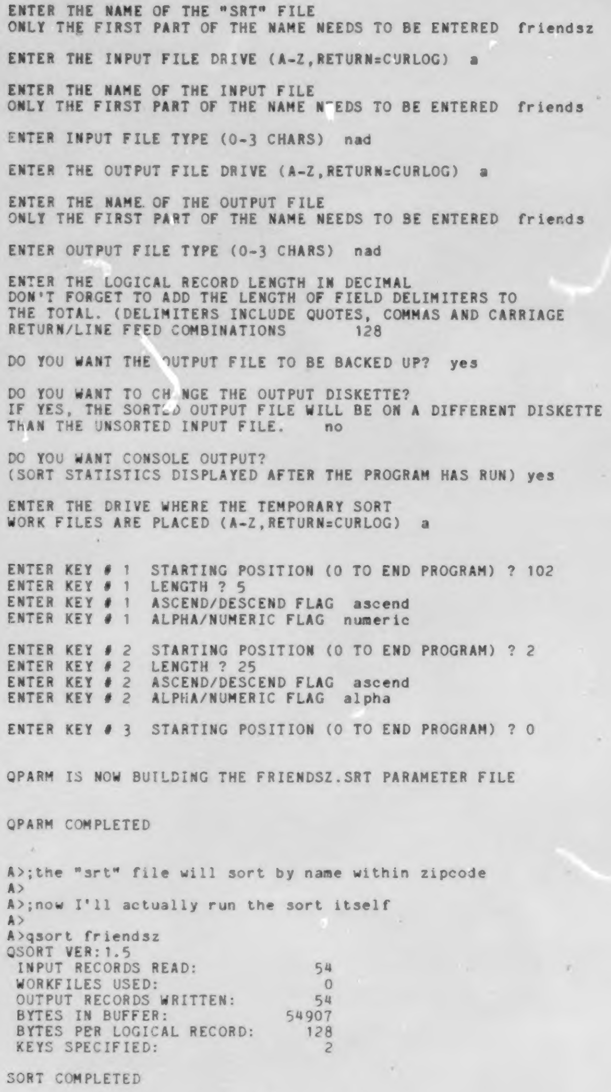
These two patient accounting systems perform complete medical or dental billing, insurance billing, and patient data base retrieval. (SH; runs on most machines; $D)

Sort—General Purpose Disk Sort/Merge

The Sort system provides an easy-to-use sort/merge system for sequential files. This system supports user-defined file sorts and merges. (SF; runs on most machines; $D)

Qsort

This is one of the most important programs in this section. It sorts lists based on your alphabetic or numeric data into ascending or descending order. (SSG; runs on most machines; $D)



```
ENTER THE NAME OF THE "SRT" FILE
ONLY THE FIRST PART OF THE NAME NEEDS TO BE ENTERED  friendsz

ENTER THE INPUT FILE DRIVE (A-Z,RETURN=CURLOG)  a

ENTER THE NAME OF THE INPUT FILE
ONLY THE FIRST PART OF THE NAME NEEDS TO BE ENTERED  friends

ENTER INPUT FILE TYPE (0-3 CHARS)  nad

ENTER THE OUTPUT FILE DRIVE (A-Z,RETURN=CURLOG)  a

ENTER THE NAME OF THE OUTPUT FILE
ONLY THE FIRST PART OF THE NAME NEEDS TO BE ENTERED  friends

ENTER OUTPUT FILE TYPE (0-3 CHARS)  nad

ENTER THE LOGICAL RECORD LENGTH IN DECIMAL
DON'T FORGET TO ADD THE LENGTH OF FIELD DELIMITERS TO
THE TOTAL. (DELIMITERS INCLUDE QUOTES, COMMAS AND CARRIAGE
RETURN/LINE FEED COMBINATIONS        128

DO YOU WANT THE OUTPUT FILE TO BE BACKED UP?  yes

DO YOU WANT TO CHANGE THE OUTPUT DISKETTE?
IF YES, THE SORTED OUTPUT FILE WILL BE ON A DIFFERENT DISKETTE
THAN THE UNSORTED INPUT FILE.    no

DO YOU WANT CONSOLE OUTPUT?
(SORT STATISTICS DISPLAYED AFTER THE PROGRAM HAS RUN) yes

ENTER THE DRIVE WHERE THE TEMPORARY SORT
WORK FILES ARE PLACED (A-Z,RETURN=CURLOG)  a


ENTER KEY # 1  STARTING POSITION (0 TO END PROGRAM) ? 102
ENTER KEY # 1  LENGTH ? 5
ENTER KEY # 1  ASCEND/DESCEND FLAG  ascend
ENTER KEY # 1  ALPHA/NUMERIC FLAG  numeric

ENTER KEY # 2  STARTING POSITION (0 TO END PROGRAM) ? 2
ENTER KEY # 2  LENGTH ? 25
ENTER KEY # 2  ASCEND/DESCEND FLAG  ascend
ENTER KEY # 2  ALPHA/NUMERIC FLAG  alpha

ENTER KEY # 3  STARTING POSITION (0 TO END PROGRAM) ? 0


QPARM IS NOW BUILDING THE FRIENDSZ.SRT PARAMETER FILE


QPARM COMPLETED


A>;the "srt" file will sort by name within zipcode
A>
A>;now I'll actually run the sort itself
A>
A>qsort friendsz
QSORT VER:1.5
 INPUT RECORDS READ:            54
 WORKFILES USED:                 0
 OUTPUT RECORDS WRITTEN:        54
 BYTES IN BUFFER:            54907
 BYTES PER LOGICAL RECORD:     128
 KEYS SPECIFIED:                 2

SORT COMPLETED
```

Q-sort output sample

Selectrasort

This complete mail list data base system lets you create a list that fits your needs. You will enter customers, clients, and contacts with addresses and other relevant information. (SH; runs on most machines; $D)

Datamerge

Using this form-letter generator, you can specify the name of a form and data will be merged into it. This program will create "personalized" and pointed sales pitches, order follow-ups and other useful documents. (SH; TRS-80, Apple, North Star; $D)

PROFESSIONAL

If you don't own a small business, can you still make a computer pay for itself? Yes! The ten programs in this section will help you manage your time and money more effectively. There are even programs that relate to specific occupations.

Wordstar

This screen-oriented, integrated word processing system was designed for the novice. Whether you are writing letters or books this program can help. (MP; runs on most machines; $D)

Textwriter

This text-writing program formats files created by a separate editing program. It is perfectly suited for printing personalized form letters, reports and manuals, contracts and specifications, or books and articles. You would use it in conjunction with a word processing program, e.g. Wordstar. (OS; TRS-80, Heath H89, Heath H17, Polymorphic, North Star, Exidy; $D)

Property Managment System

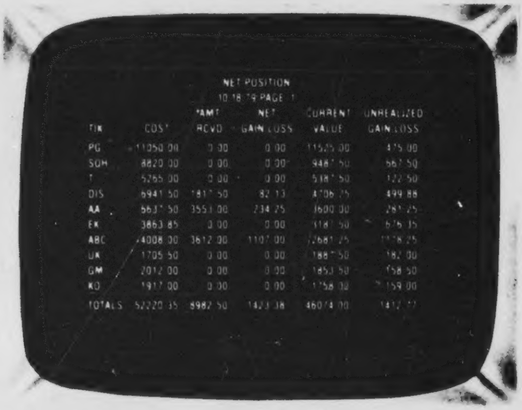
Do you own some rental property? If so, this program can be a great help. It is a full general ledger system that provides management and accounting control for all types of income properties. Its major features include: budgeting, rent roll, delinquent tenant reports, lease expiration report, vacant unit reports, last rent report, vendor report, and check writer. (ATE; runs on most systems; $D)

Stock-1

How would you like a program that keeps track of your stock holdings and your net worth? This program will do that and more. After you have entered today's price of a stock, Stock gives you a summary of that stock, including original cost, market value, profit with/without dividends, annual rate of return and holding period. (MA; TRS-80; $B)

Stockpak

The basic Stockpak system is a set of portfolio management programs. It allows you to screen a data base and create reports according to your own investment criteria. One important part of the system is that you can obtain a great deal of investment information from Standard and Poors. (STP; TRS-80; $C)



```
                        NET POSITION
                       10/18/79 PAGE 1
                      *AMT       NET       CURRENT    UNREALIZED
TIK        COST       RCVD    GAIN/LOSS     VALUE      GAIN/LOSS
PG       11050.00      0.00       0.00     11525.00      475.00
SOH       8820.00      0.00       0.00      9487.50      667.50
T         5265.00      0.00       0.00      5387.50      122.50
DIS       6941.50   1817.50      82.13      4706.25      499.88
AA        5637.50   3551.00     234.25      3600.00      281.25
EK        3863.85      0.00       0.00      3187.50      676.35
ABC      14008.00   3612.00    1107.00     12681.25     [illegible]
UK        1705.50      0.00       0.00      1887.50      182.00
GM        2012.00      0.00       0.00      1853.50      158.50
KO        1917.00      0.00       0.00      1758.00      159.00
TOTALS   52220.35   8982.50    1423.38     46074.00     1412.77
```

An example program for the Stockpak System

Visicalc

Take virtually any problem you would explore using calculator or pencil and paper, working in rows and columns. Apply

Visicalc and you have an electronic worksheet of 64 columns by 254 rows. This is a powerful tool for working with numbers, financial analysis or business modeling. (PS; Apple, PET, Atari; $B)

A sample output from Visicalc

Datebook

This program is designed for doctors, dentists, lawyers, or anyone who must schedule appointments. It manages time just like an office appointment book. (OS; TRS-80, North Star, $D)

TUESDAY
PHONE
FIFI

Surveyor

This package is a set of computer programs and plotting routines created for surveyors. It is designed to automate many surveying processes and thus relieve you of the tedious and error-prone activities encountered during computation and mapping. (PTS; runs on most machines; $C)

Decorator's Assistant

The integrated set of five programs will compute the amount of materials needed to redecorate any room. It also computes cost. All you do is enter room dimensions, number of windows and doors, and base cost of the material. (IS; PET; $A)

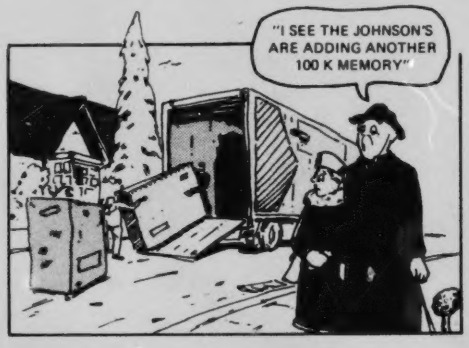
Grade Book

If you are a teacher, this program will be like manna from heaven. Just type in grades for tests, quizzes, homework, classwork, etc. The Grade Book will calculate and display individual grade averages. (IS; TRS-80; $A)

Chapter 3

A Computer For Your Home

Not long ago a student in a course on small computers announced that she and her husband had taken the plunge. They had ordered their own computer! Thinking everyone we know was in the same state of inflationary poverty that has a long term lease on our bank accounts, we assumed the happy owners had scraped together enough to get one of the $499 specials. Actually, the cost of their system was over $2000.


"I SEE THE JOHNSON'S ARE ADDING ANOTHER 100 K MEMORY"

They had purchased from Radio Shack a TRS-80 with an expansion interface, dual disk drives, and 32K of memory. (Don't be alarmed if you don't know what these terms mean. You will. You will.)

Why would a middle-class family spend $2000 on a computer system? This family had several reasons. They enjoyed games and felt the variety available for the TRS-80 would keep them

A TRS-80 disk system

entertained for years. The computer would also serve as a home tutor for the children. Also, as a high school teacher, the student wanted the computer to keep track of her grades. Both she and her husband were looking forward to learning BASIC, and had several ideas which they hoped to turn into working programs.

Computers find many uses in the home

Is this the typical "computer family?" Not really. In fact, there is no such thing as typical in this field. Most potential buyers want to use their computer for one or two major applications. Those "major" applications are the ones you use to justify buying a system in the first place. A friend of ours, for example, is a research psychologist at a center for retarded adults. He writes a number of articles and monographs each year. He bought his computer to analyze data and to serve as a word processing system.

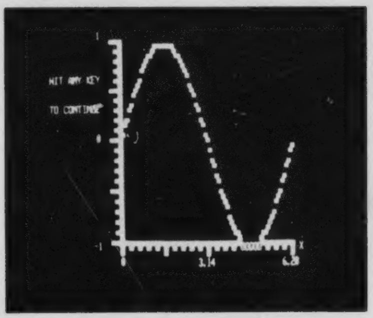
For most people, there will be some, perhaps many, secondary reasons for buying a computer. These secondary reasons aren't enough by themselves to justify buying a computer, but once they are proud owners, the secondary uses can actually take up more of the computer's time than the major uses. The research psychologist and his friends have so far spent more time playing an intriguing computer game called "Air Mail Pilot" than doing complicated statistical analyses.

STEPS IN SELECTING A SYSTEM

The process of buying a computer is complicated a bit by versatility. Buying a microwave oven or a color television is much simpler since they are single function devices. Computers, on the other hand, can do many things – they entertain, they teach, they keep financial records, and they do much more. Not all the computers available, however, do everything equally well. Therefore, a first major step in selecting a computer is identifying the jobs you want it to do.

Step One. Identify Major Uses

It may seem simplistic and obvious to say you need to decide just what you want the computer to do. You would probably be surprised, though, at the number of people who buy a computer with only a vague idea of exactly what it will be used for. Suppose you visit a local computer store and take a fancy to the Texas Instruments computer. It does show well in the store. The programs are well written, they execute with little if any difficulty, and the results are in excellent color with quality graphics. After buying the TI system you may decide that your primary use will be word processing with games a secondary use. Unfortunately, the TI system is excellent for games, very good for educational uses, but virtually impossible to use as a word processor. For the same amount of money you could purchase a system that is very good for word processing and acceptable for games and recreational uses.



An example of computer graphics

This first step, then, is the most important. Decide what your major uses will be. Once that's clear it will be easier to identify the computer systems that are capable of doing the work you want done. Some common applications are recreational games, educational uses, statistical analysis, support for hobbies such as amateur radio, musical applications, computer art, word processing, financial record keeping, inventory management, and timesharing (ability to "talk" to a large computer over the phone).

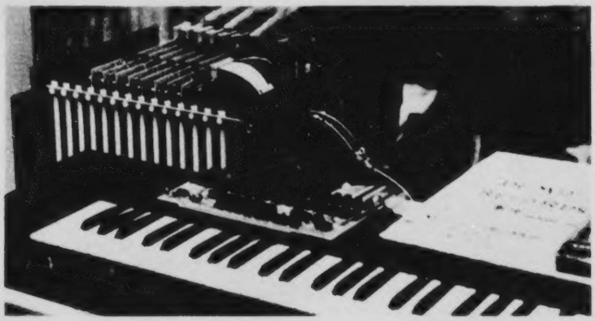
Step Two. Specify Minimum Requirements and Preferred Features

Once you clearly specify the major uses, you will need to specify the features a computer must have to do these jobs. The Texas Instruments computer mentioned above, has a small "calculator" style keyboard rather than a "typewriter" style keyboard. A computer used as a word processor must have a keyboard that permits fast touch typing. It is next to impossible to touch type on the TI unit and thus very difficult to use it as a word processor. This is just the first of a number of minimum requirements for word processing. Another preferred feature would be a video display that can put 24 lines of 80 characters on the screen at one time. A person can do very nicely with a display of 16 lines by 64 characters (a minimum requirement), but a larger display is quite useful.

None of the requirements noted above for word processing is essential, perhaps not even desirable, in a computer that is to be used solely for entertainment. Instead, you may want to consider characteristics such as color display, high quality graphics, availability of inexpensive programs, and provision for plugging in game paddles. The final section of this chapter discusses a number of potential characteristics or features for computers. Few people will find all of them equally important. Your intended uses will determine which features are crucial, which are important, and which are of little relevance.

Step 3. Identify Likely Secondary Uses and Desirable Machine Features

Suppose you've narrowed your choice of computers down to two systems. Both will do your major jobs well, both cost around $1100 with accessories. The choice may come down to secondary use capabilities. For example, if your family has a strong interest in music, you may want to consider a music synthesizer board. This $250 option can bring you and your family many hours of enjoyment. Even if you don't buy the music board with the computer, it might be a good idea to buy a computer that allows you to add this feature later.

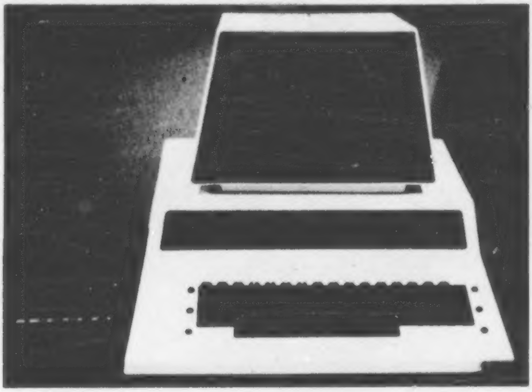


A computer music system

40

Step 4. Decide How Much You Want to Spend—Now and Later

Now comes the crunch. If your finances are anything like ours, you will have to compromise when you reach Step 4. It is possible today to buy a complete, fully functional computer for prices that range from $200 to millions. Most microcomputers cost between $299 and $3000 with the most popular systems selling for between $600 and $1500.



The Commodore PET Computer

In the last three years, we've been involved in buying over 15 different computer systems. In every case, had we been able to spend $500 more, we would have bought a different computer. The $600 PET and the $2000 North Star computers, for example, can both be used to do similar jobs. The North Star, however, does many of them better, and has features (e.g. disk storage) that are not available or are optional extras on the PET. With few exceptions, you get what you pay for. Price differences in computers generally reflect differences in the features of the computer and the quality of the components. Before you pay more, though, be sure the features you're paying for are ones you need.

A final price consideration you should keep in mind is how much you may have to spend later. We know of an owner who purchased a system for a very good price only to discover that the cost of expanding that system was very high. If you plan to buy additional equipment for your computer later be sure the cost will be reasonable.

Another potential shock for the new owner is the cost of service. Some companies such as Heath and Radio Shack maintain regional repair centers that provide service at a fair price. Other manufacturers have little or no service in much of the U.S. The owner of one such "orphan" system was told that even minor service would cost $120 plus parts each time a serviceperson looked at the equipment. This may be typical and expected in the business world where large, complicated systems must be kept at peak operating efficiency, but small computer owners are likely to find the cost excessive.

Step 5. Survey the Field

Now that you know how you want to use your computer and you have a fairly good idea of what you can spend, you can begin the tire-kicking phase. Chapter 7 contains descriptions of the major small computers available at the end of 1980. It is only a starting place, however, since new and improved models are being introduced on a fairly regular basis. More up-to-date information can be obtained by visiting local computer stores and from reading current issues of magazines such as *Interface Age*, *Microcomputing*, *Byte*, *Creative Computing*, and *Personal Computing*.

We would suggest you limit yourself to computers already on the market rather than those announced as being available "in the near future." In this industry the near future can be as long as three years. In some cases new models which are announced

SORRY ABOUT THE DELAY MR JAMES

(and for which orders are accepted) never appear. The same goes for announced accessories. If you want a computer with a compatible printer from the same company, look only at systems with acceptable printers already available rather than systems for which a fantastic printer is "in the works."

Step 6. Survey Sources

Steps 5 and 6 should probably be completed at the same time. As you check out computers for suitability, also evaluate the potential sources of supply. Most computers are purchased from one of three sources: a local or regional computer store, a mail order supplier, or the manufacturer. Fewer and fewer manufacturers are willing to sell directly to the consumers today. Most prefer instead to deal with distributors and dealers who, in turn, sell to consumers. This frees the factory to concentrate on production and development; the dealers provide most of the customer service.

The other two alternatives, computer stores and mail order companies, are a mixed bag. There are excellent examples of ethical, responsible businesses in both categories. There are also examples of plain crooks, inept ne'er-do-wells, and fast buck Olympians in both categories. A good local store with a top-notch technician who provides timely service is hard to find. Prices at such a store may be a bit higher than they are from mail order discounters, but many people feel the extra price is worth it to have the person responsible for the warranty just down the street. If you're not sure about a store, take the time to get opinions from computer owners in your area. We once considered buying an Apple II from a local dealer so we could get quick service. You can imagine how we felt when we found out that the dealer had no service personnel at all for Apple computers. When an Apple went down (needed repair) it was shipped back to the factory in California. Since the dealer's price for an Apple was $200 more than the mail order price, we reconsidered the purchase. Apparently many other people did the same. The store is no longer in business.

Mail order suppliers are a little more difficult to get a fix on. Some companies such as Hobby World, Advanced Computer Products, Jade, and Percom have good track records. Many mail order suppliers have a staff of service technicians and provide timely repair service. Others are slow at delivering goods in the first place and even slower at handling service requests. One way to protect yourself is to read the letters and commentaries about mail order companies in computer magazines. Two particularly helpful columns are Tim Barry's commentary in *Info World* and Wayne Green's editorials in *Microcomputing*.

Step 7. Buy It

There's not much else to say. Once you've done your homework go out and buy yourself a computer!

POTENTIALLY IMPORTANT FEATURES

Video Display

Nearly all the current models use a video display for normal operation of the computer. All video displays are not created equal, however. Some display as few as 12 lines on the screen at one time and have only 32 characters on each line. That's a little on the skimpy side. The standard displays for small computers can put 16 lines on the screen with 64 characters on each line. The 16 by 64 format is the minimum for word processing and 24 by 80 or 30 by 80 is desirable but often expensive.

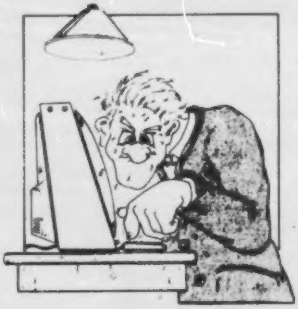
For recreational computing and educational applications two other features, color and graphics, are more important than the character display capacity. Several of the newer models offer color displays rather than the traditional black and white. Color adds zest to games and makes computer-assisted instruction programs more interesting. Most computers also have at least some graphics capability. This means that the computer can display figures, graphs, charts, game boards, or computer-generated pictures on the screen in addition to letters and numbers. In inexpensive computers, such as Radio Shack's TRS-80, the graphics capability is limited but useful. The Texas Instruments computers have sophisticated graphics features which can create very fine-grained displays. In addition to educational and game applications for personal applications, businesses can use color graphics to create sales displays and charts and figures for meetings.

Unfortunately, the computers which have high quality color graphics generally skimp on the capacity of the display. The TI computer, for example, has very good color graphics but one of the smallest capacity displays. The Apple II has a similar drawback although there is a commercial conversion package that gives the Apple II a large-capacity display. One computer you might want to consider is the Compucolor. It comes with color graphics and a large display capacity. As you might expect, Compucolor costs more than any of the other computers mentioned.

Two other points should be made about the video display. First, while most computers have video display "capacity," not all of them come with video monitors. This is an option on some computers. Monitors cost from $75 (for used equipment) to $500 or more (for high quality video monitors). Second, while all systems will display letters and numbers, some display only upper case or capital letters. The TRS-80, for example, is an "upper case only" machine although Radio Shack does offer a lower case conversion kit for around $60.

Keyboard

Perhaps we're fanatics about keyboards, but they can determine whether working with the computer is a joy or a pain. Two manufacturers, Commodore (PET) and Texas Instruments, saw fit to produce computers with midget-sized keyboards resembling those on calculators. The keys are small and closely spaced. They are not our cup of tea. If you have big fat fingers, like we do, they are hard to use without making errors, and there is no way to touch type on these tiny keyboards.



The sight of a full-sized, typewriter-style keyboard on your intended computer does not mean all is well, however. A good keyboard should offer smooth resistance to the touch without catching, and the whole assembly should be firmly mounted with no flexing. Finally, the keyboard should be free of "keybounce." You have keybounce when you type an "a" on the keyboard and "aa" or "aaa" appears on the screen. Keyboards with contact points exposed to dust are particularly susceptible to keybounce. The early model TRS-80's win the prize for keyboards with the most keybounce. After a West Texas dust storm some of our TRS-80's were virtually unusable. Tandy wisely scrapped its original keyboard in the middle of 1980 and now uses a very good one on its computers. Keyboards manufactured by Keytronic and Cherry are generally superior as are "capacitive" and "Hall effect" keyboards. Check out the keyboard carefully before you buy.

ASCII keyboard

Power Supply

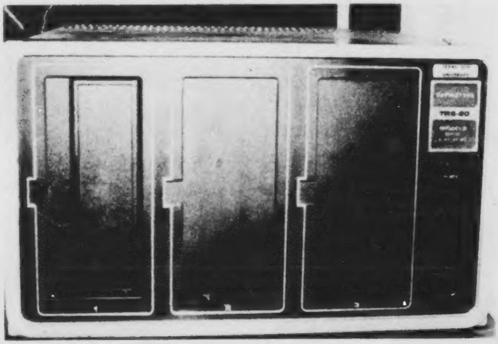
Most of the power supplies in current models are at least adequate. However, many cannot handle the extra load of additional accessories you may want to add later. The virtues and vices of power supplies are discussed in more detail in Chapter 5.

Storage Medium Options

Most small computers come with cassette storage systems. Programs or data you want to save can be recorded on regular (but good quality) audio cassettes. Cassette storage is cheap, often reliable, and easy to use. Unfortunately, it is slow. A large program can take as long as three minutes or more to load. That may not sound like a long time now, but when you're sitting in front of the computer it can be forever, particularly if there are problems with the load and you have to do it again . . . and again . . . and again. It is also easy to end up with a hundred or more tapes scattered around the computer. Finding the one you need can take longer than a visit to the dentist.

While most computers today have at least passable cassette systems, there are a few which leave a great deal to be desired. Some leave everything to be desired. Fortunately, the worst of the cassette systems are gone now. The companies that created them went under. The ones left vary considerably in dependability and speed. Radio Shack has a fairly slow cassette system which is also one of the more undependable. There are several "fixes" for the system which seem to improve its reliability; a few also increase its speed. New TRS-80's have an extra circuit that improves reliability. It's about time. Other computers such as the Exidy Sorcerer have faster cassette systems that work well. The Sorcerer actually has a two-speed cassette interface – a slow and very reliable speed and a fast and fairly reliable speed.

A popular alternative to cassette storage is the "floppy disk." Floppy disks are fast, very reliable, but expensive. Expect to pay at least $400, perhaps as much as $900, for a small disk system. For that, you get a high speed, highly reliable storage



A disk system for a small computer

system. Computers from Heath, Compucolor, and North Star have built-in disks in lieu of cassette systems. They cost more but load that three minute cassette program in two seconds. If you can afford them, disks are the only way to go. Disks can be added to computers with cassette storage but the cost will probably be more than buying a system with the disk built-in.

Disks come in two sizes (5½ inch and 8 inch) and from several different manufacturers. The capacity of the disks varies according to size and type, but a great deal of data can be placed on even the smallest disk. While there have been some quality control problems with some manufacturers, the overall level of quality in floppy disk systems is reasonably high.

Base Cost and Expansion Costs

It's probably natural to compare computer prices by looking at the price tag on the keyboard. But that may not tell all the story. Suppose you've narrowed your choice to two computers which meet your needs. Computer A lists for $500 and computer B costs $950. Your system will require 32K of memory, a good BASIC, a connection for a serial printer, and word processing software. The "inexpensive" computer has 4K of memory which must be removed to install a larger 16K block of memory. (A "K" is a measure of computer memory. 1K equals 1024 data elements, 2K equals 2048, 4K equals 4096, etc.) The cost for that is around $100. Adding another 16K of memory requires buying an expansion chassis which costs $300. The additional 16K (for a total of 32K) is another $100. The cost of a serial printer port is one more $100 bill. Then there's $100 for a good BASIC and $100 for the word processing software. This brings your "inexpensive" computer cost to $1300.

The "expensive" computer, which lists for $950, has 16K of memory and a connection for the printer as standard equipment. There are also sockets inside the computer for an additional 16K of memory. The memory will cost $100. A good BASIC is also supplied with the computer as standard equipment, and word processing software is around $200. That brings the cost of the expensive system to $1250 which is $50 less than the cheaper system.

The point is, you should always consider the cost of expanding a basic system to meet your needs, not just the price of a "bare bones" computer. Some computers are barer than others.

Software Availability

There are a few computers (Apple, PET, TRS-80, and North Star) which have gained such wide acceptance that many different companies sell all sorts of programs for them. Since without software a computer is just a bunch of parts, the variety and quality of software available for a particular computer thus becomes an important point to consider when buying a system.

With most of the major small computers you will probably be able to buy at least one or two programs in each of the major applications areas. Newer computers, and those from less well accepted manufacturers, have not attracted as much interest from independent programmers, and there is no guarantee that a large number of suitable programs will be available. It is best to check first and be sure appropriate programs are available for the computer you are interested in.

One reason we purchased several TRS-80's for our small computer lab at Texas Tech was the availability of a wide range of software. Other companies may offer a computer with better hardware, but few, if any, have as much software written for their computer.

Software availability involves more than applications programs, however. For those who want to roll their own programs, the range of computer languages which can be used on a computer is also important. It would be hard to find a computer

that does not have at least one BASIC for it. Several have three or four versions. Some small computers can also be programmed in the traditional languages of the big computers – FORTRAN and COBOL – as well as in specialized languages like PILOT (for computer-assisted instruction). Being able to choose from among several programming languages gives you more options.

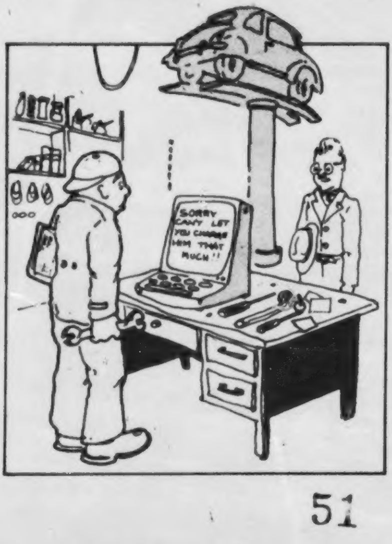
Try to get the best deal you can on your computer but don't put so much emphasis on price that you neglect performance. It can be a lot of fun owning a computer but it can also be a lot of misery. Have fun!

Chapter 4

A Computer For Your New Business, Old Business, or Monkey Business

If you are in business you need a computer. It is as simple as that. You may think that your business is too small, but it isn't too small, not if it supports you. Every company from the service station to the giant corporation can save money by using a computer. You already know about the giant corporation, so let's talk about a service station owner. Let's call him Joe.

The Down Home Gas and Supply, as Joe calls his station, is a popular place. Joe sells gas at 10 cents above his cost and he only charges $15.00 an hour for mechanical work. Best of all,


SORRY CAN'T LET YOU CHARGE HIM THAT MUCH!!

he is an excellent mechanic. He pumps his full allotment of gas each month. His profits from his gas sales cover most of his overhead, but he does have to do some mechanical work to break even. Therefore, his earnings come from his mechanical work and the sale of parts which increases in direct proportion to that work. Consequently, he can make about $17.00 an hour as a mechanic. He spends about 30 hours a month on his books (1 hour a night and 4.5 hours extra at month's end). If he can cut his bookwork by two-thirds and do more mechanical work instead, he will increase his revenue by $340.00 a month. He can do this with a computer that costs less than $200.00 a month.

A computer won't solve all of Joe's problems, but it will help. It can keep track of his payroll, figure deductions, payments, and so on. In fact, it can do most of his accounting. It can even monitor the investment he made in a piece of land with his brother-in-law. Using careful inventory control, he can be sure he has enough of the parts he needs and can return or sell those he doesn't need. He doesn't have to save a great deal of money to be able to make it all worthwhile.

Small computers are so inexpensive that any business can afford one. You can buy a small business computer system for as little as $2,500.00 or as much as $100,000.00 It all depends on what you want. Obviously, the $100,000 computer will do a lot of things the $2,500.00 computer won't. The real trick is to pick the right one. The TRS-80 system shown below sells in the $3,000-$4,000 range. It would be ideal for someone

The TRS-80 computer system

like Joe. If your business has sales of $3,000,000 or more, or you feel you can afford to pay $20,000 for a computer, hire a consultant. We will confine our discussion to computer needs of smaller businesses, and we can suggest a couple of dilithium Press books that will be of some help: *Small Computers for the Small Businessman* by Rosa and Rosa and *From the Counter to the Bottom Line* by Warren and Miller. Either of these books will be of help to you in choosing any size business system. We will try to guide you in two ways. First, we will give you some general selection criteria. Then, we will describe a small system.

When you buy a computer for your business, you are making a major decision. Therefore, you should be as careful as possible. The buying steps we outlined in Chapter Three can be a very good starting point, so we will briefly review them here.

Step One: Identify your major uses. If you buy a typewriter or a truck, you have a specific use in mind. The same should be true when you buy a computer.

Step Two: Specify minimum requirements and preferred features. This is where you get down to the real nitty-gritty. The hardware items you want for sure are 32K of memory and a good printer. The minimum software packages you want are an accounting package and a word processing package. But what else do you need?

Step Three: Identify likely secondary uses and desirable machine features. One of your secondary interests might be home use. If your business is small, you may even want to house the system in your home. In addition to providing you and your family with personal benefits, you might also get some tax advantages.

Step Four: Decide how much you want to spend–now and later. Are there ways of buying the computer that will save you money? Should you buy outright? Should you rent or lease? If you do buy outright, should you pay cash or should you finance?

Step Five: Survey the field. This is so important for a business computer user that there is no way we can overemphasize it. The microcomputer is an outgrowth of the semiconductor industry, *not* the computer industry. This is both good and bad. The good news is that a complete computer system is priced within reach of any small business. The bad news is that you have to go through a lot of chaff to get to the wheat. Most small computer companies and computer stores were started by engineers or computer hobbyists. Many of these people are absolute geniuses, but they don't understand business computing at all. Our advice is to be careful and talk to a lot of people. It is not like buying a car.

HAVEN'T COME ACROSS THIS ONE BEFORE!!

Step Six: Survey sources. If you are buying a personal computer, you have several places to choose from. If you are buying a business computer the *only* places to go are *business* computer dealers unless you are able to purchase directly from the manufacturer. It is probably best to go to an established dealer, but it is not crucial. Most of these dealers were not in this business six years ago, so judge all of them as being essentially the same. Find out as much as you can about the people who own and run the store.

Step Seven: Buy it. Read the rest of this book first. How you handle your three most important resources will determine your success. These resources are time, people, and money. A computer should be considered a tool to help optimize the use of one or more of these resources. Because the computer is merely a tool, it must have a specific job. If you define this job carefully, your selection process will be a lot easier. To help define this job, ask yourself these questions:

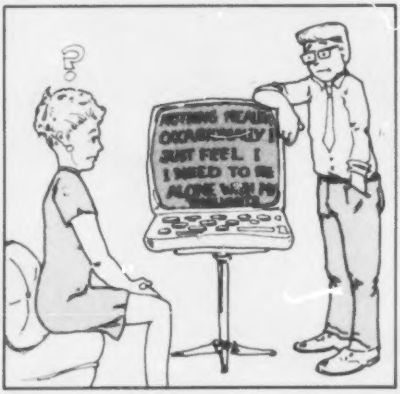
1. What data must I get from the computer?
2. What form should this data be in?
3. How much storage do I need?
4. What is it going to take to input my data?
5. What would I like the computer to accomplish?

We will define the term data here, but you don't have to understand the term to understand this process. Data is the facts and figures you use in your business. Starting with item one above, the first thing to do is make a list of the data you want from your computer. A sample list for Joe's service station is shown below:

1. Gas pumped on a daily, weekly, monthly and yearly basis.
2. Customer list: Should include home address, phone number and type of car (or cars) and perhaps a maintenance record for each.
3. Inventory of parts carried: Should show what is selling and what isn't. For instance, do we sell more radial tires than two-plys, and what is the difference in profit margin on these items?
4. Bookkeeping: Keep track of payroll, taxes, sales, etc. Maybe we can come up with some reports that will save the accountant some time.

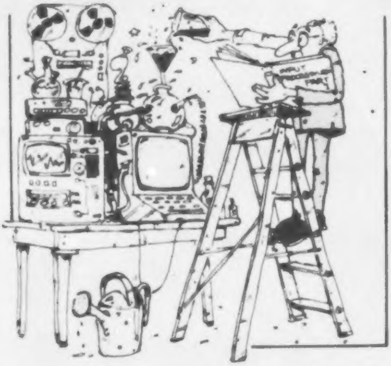
Once you've made your list, revise it. If someone else is interested in your business, ask for help. Try to think of every possible thing you can do with your computer.

The four remaining questions should be fairly easy once you've answered question one carefully. Data is of little use to you if you have to spend a great deal of time interpreting it. Do you need word descriptions of items or will numbers do? What form do you want this data in now, and how can you improve it?



Data storage capacity can be expensive. A moderate increase in your storage requirements can, in some cases, increase the cost of your system by as much as 50 to 100%. The little 5¼-inch disk systems store from 100K to 1000K of data and are fairly inexpensive. The 8-inch systems store more, but cost more, and the hard disk systems that store millions of items of data are big buck items. Therefore, take care in answering question three. Break your needs down into two categories, short term and long term. Short term should mean only data that is referred to and used daily. You'll be surprised at how little this really is. You should look at computers that can handle a little more than the short term load. You don't want to run out of memory right in the middle of order processing, but you don't want to buy more than you need. As a general rule, one 8½-inch X 11-inch double-spaced, typewritten page is a little less than 2K. Many small business needs can be met with 32K and one or two 5¼-inch disk drives. That 32K will hold less than 16 pages of data, since you'll have to have some memory space for the computer program itself.

Question four is a matter of form. Just as you have some preferred ways of getting data out, you probably have a preferred method of putting it in. If you answered the first three questions carefully, you should know the answer to question four. One of the three primary resources is time. Don't waste time by using a computer that has a complicated input procedure.



A computer can help you get the most use from your three resources but you have to determine how. That is the purpose of question five. Make three lists with these headings: time, people, money. Under each one, jot down ways you can optimize how these resources are used. For instance, under "money," can you manage your cash flow better? Can you compute your profit margin more accurately? Control inventory?

If it sounds like you need a computer to figure all this out you are probably right. But, you need to analyze these things even if you don't have a computer. So, what you need now is a good plan, and we"ll give you one.

1. Get out a pencil and paper. Take a pass at answering the five questions.
2. Read the rest of this book. (It's been good so far, hasn't it?)
3. Read some other books on the subject. (In fact find out as much as you can about small computers.)
4. Decide how much you can spend.
5. Talk to several different vendors and look at lots of computers.
6. Before buying anything, read some more if possible.

Our purpose in this book is to give you an overview of small computers. After reading this chapter, we hope you will want to find out more.

With this in mind, let's turn our attention to a specific machine. There are a lot of good business systems available and ISSI – general business and word processing system is one of the best. ISSI (Information Support Systems, Inc., 2049 Century Park East, Suite 2095, Los Angeles, CA 90067) was created in 1978 to fill the vacuum between two existing markets. A large number of companies catered to the hobbyist and/or the computer specialist, while a lot of other companies catered to the needs of large companies. The small and very small businesses were ignored. Since that time a large number of companies have come out with a business machine, but ISSI remains one of the best. The company was founded by ex-IBMers who successfully transferred large system capabilities to microcomputers. ISSI's basic concept is quite good: to develop a system priced in the $10,000 to $15,000 range, usable by a layman with limited or no computer experience, that can be purchased, leased, rented, or bought on a conditional sales contract. The ISSI computer meets this goal admirably.

The ISSI integrated business system is a simple approach designed to support a variety of business needs.

There are two important parts of every computer: the hardware (the machinery itself) and the software (the programs). The

ISSI, Information Support Systems, Inc. computer

hardware consists of a keyboard, a 12-inch video screen, two floppy disk drives, and an electronic circuit board behind the screen which does all the work. In addition, there is a printer. The entire ISSI computer is in an attractive compact desk-top unit weighing less than 40 pounds.

You use the keyboard when you want to talk to the computer. It has a typewriter keyboard with a few things added. For instance, the copy function key allows the user to make a copy of a line or paragraph(s) within a document. The escape key allows users to change their mind if they type something they didn't intend to. There are other special keys for word processing. We will describe them later.

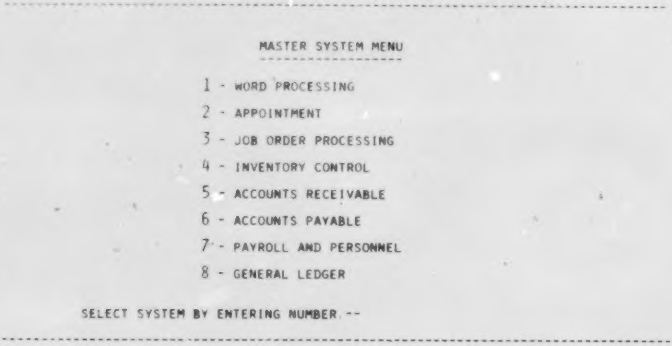
The numbers 0 through 9 are located in two places on the keyboard. There is a top row of number keys similar to those on a typewriter, and there is also a calculator-type 10-key pad on the right side of the keyboard.

The computer talks back by asking you questions on its screen or *video display*. The video display is a cathode ray tube similar to the one in your television set. The ISSI computer displays information on its screen at a speed of up to 30,000 words per minute.

You will also want to use some kind of a printer. ISSI gives you the option of selecting one of two kinds: a printer that provides snazzy, professional-looking documents, or a less expensive model that is not quite as slick.

The last piece of hardware is the disk. Some manufacturers sell the disks as a separate item, but ISSI incorporates disks into their total machine. Data, both yours and the programs for the ISSI system, is stored on *floppy disks* or *diskettes*. These diskettes, which look a lot like 45 rpm records, are inserted in the disk drive on either side of the video display. Generally, you insert an instruction disk on the left side and a working disk on the right side. The instruction disk contains the software for the package you want to run. The working disk contains your data.

The ISSI software contained on the instruction disks comes in eight different packages. When you insert the instruction disk, the first display you will see is a menu listing. This is shown below.



```
                    MASTER SYSTEM MENU
                    ------------------

               1 - WORD PROCESSING
               2 - APPOINTMENT
               3 - JOB ORDER PROCESSING
               4 - INVENTORY CONTROL
               5 - ACCOUNTS RECEIVABLE
               6 - ACCOUNTS PAYABLE
               7 - PAYROLL AND PERSONNEL
               8 - GENERAL LEDGER

     SELECT SYSTEM BY ENTERING NUMBER --
```

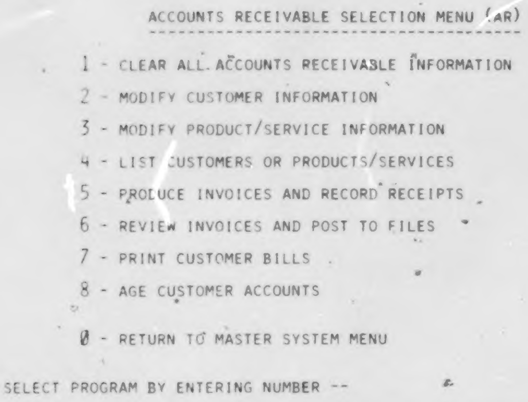
Main menu listing of a business program

If you want to do Accounts Receivable you would type 5 and press **RETURN**. To give you a general idea of how business systems work, we will take you through part of the A/R package.

Each business package works the same. In each, the computer will store information for your future use. In Accounts Receivable, both a customer file and a product file are maintained. The customer file contains information such as each customer's name, billing and shipping address, customer type, whether the customer is subject to finance charges or not, whether the customer is paying on a 30/60/90 financing program, his line of credit, the date and amount of the last payment, and the amount of money still owed by "age" categories.

The product file contains information such as the stock number and a description of the product, the price of the product and the general ledger account number which should be debited when this product is sold. The file also contains information helpful for sales analysis, such as profit margins, and the total number of items sold this week, this month and this year to date.

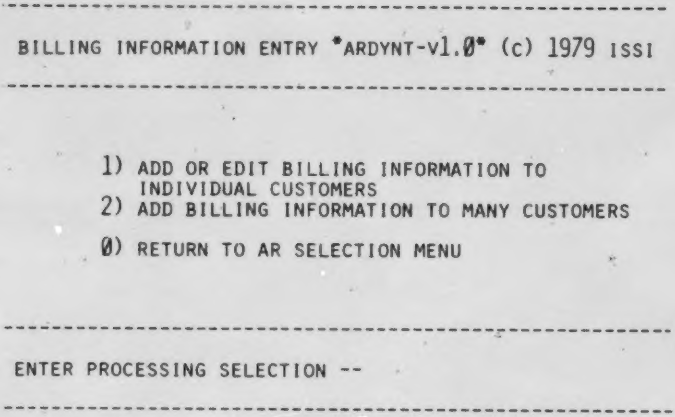
When you type 5 you will get the display shown below. The selections on the A/R menu help you update or modify files, produce invoices, record receipts, print bills (including finance charges if applicable) age accounts, and print reports.



```
              ACCOUNTS RECEIVABLE SELECTION MENU (AR)
              ---------------------------------------

        1 - CLEAR ALL ACCOUNTS RECEIVABLE INFORMATION
        2 - MODIFY CUSTOMER INFORMATION
        3 - MODIFY PRODUCT/SERVICE INFORMATION
        4 - LIST CUSTOMERS OR PRODUCTS/SERVICES
        5 - PRODUCE INVOICES AND RECORD RECEIPTS
        6 - REVIEW INVOICES AND POST TO FILES
        7 - PRINT CUSTOMER BILLS
        8 - AGE CUSTOMER ACCOUNTS

        0 - RETURN TO MASTER SYSTEM MENU

  SELECT PROGRAM BY ENTERING NUMBER --
```

Accounts Receivable selection menu

You choose the appropriate task by typing in the corresponding number. The only item we will discuss here is selection number 5, Produce Invoices and Record Receipts. You will probably use item 5 more than any other. This function helps you record the purchases and payments made by your customers. When you type 5, you will get the display shown opposite.



```
-----------------------------------------------------------------

BILLING INFORMATION ENTRY *ARDYNT-v1.0* (c) 1979 ISSI

-----------------------------------------------------------------


        1) ADD OR EDIT BILLING INFORMATION TO
           INDIVIDUAL CUSTOMERS
        2) ADD BILLING INFORMATION TO MANY CUSTOMERS

        0) RETURN TO AR SELECTION MENU


-----------------------------------------------------------------

ENTER PROCESSING SELECTION --

-----------------------------------------------------------------
```

Billing information

You can record purchases and payments made by a single customer or you can bill a large group of customers. Let's look at one customer as a specific example. When you select 1 you will get:

```
ENTER A CUSTOMER # (OR '0' TO RETURN TO PROGRAM)
```

You would then type in a customer number and press return. Next the computer will ask for a purchase order number:

```
ENTER PURCHASE ORDER NUMBER
```

If you need a salesman code it will ask:

```
ENTER (OPTIONAL) AGENT CODE _
```

Now the display shown below will appear:

```
CUSTOMER #: 3648                  BILLING DATE: 03/17/81
NAME: MERL AND JERRY'S STORE      REFERENCE: PO 971
                                  AGENT CODE: 23
ENTER A PROD/SERV (OR 0 WHEN ALL CODES ARE ENTERED)_
```

Now you are ready to record all purchases and payments for this customer. When you type in your product code you will get the display shown below.

```
CUSTOMER #: 3648                   BILLING DATE: 03/07/81
NAME: MERL AND JERRY'S STORE       REFERENCE: PO 971
        PRODUCT/SERVICE: 100       AGENT CODE: 23
DESCRIPTION: PEANUT BUTTER (CASE)
PAYMENT TYPE: *CHARGE*             1)DEFAULT PRICE: 500.00
SERVICE CODE TYPE: COM
GL ACCOUNT NUMBER: 1000.00         2)QUANTITY: 5
                                   AMOUNT: 500.00
.........................................................
ENTER 'X,X' TO ACCEPT              ENTER 'X,0' TO CANCEL
```

Now you have three choices. If "x,x" is entered, the invoice is produced and the ledger entries are made. If "x,0" is entered, nothing is done. If you decide to change the price (after all $500.00 does seem a little steep for one case of peanut butter) all you need do is type:

```
ENTER EDIT DATA_
1,6.18
```

This tells the computer that you want to change the price to $6.18. (It's a special this week only, folks.) Once you have completed your editing you can either accept or cancel. Regardless of which one you choose you will get.

```
1) ADD/EDIT NEW BILLING INFORMATION
2) LIST/EDIT OLD BILLING INFORMATION
3) RETURN FOR NEXT CUSTOMER
```

We could describe this system in even more detail but you probably get the idea, so let's go on to something else. If you would like a complete demonstration of this system, contact ISSI at 800-421-3363 if calling from outside California, or at

213-552-1820 within California. Since they maintain a direct sales force in addition to working with outside distributors, their sales manager, Jim Collins, can answer questions or arrange a demonstration for you.

Although the ISSI is an excellent machine, it is not the only computer. Many others, such as North Star, Vector Graphics, Cromemco, Apple and Atari offer solid business systems. It is very important to carefully analyze your needs and research the computer companies and dealers before you make your decision.

The next chapter is really an extension of this one. We strongly suggest that you read at least the first few pages that discuss word processing since it can be a big help to you. We hope your business prospers.

Chapter 5

Help Yourself—
The Professional's Computer

In the future, how well you use a computer may determine how successful you are. You are probably familiar with the old expression, "Genius is 90% perspiration and 10% inspiration." A computer can't do anything about the 10% but it sure can make the 90% a lot easier. No matter what your profession is, you spend a large portion of your time doing humdrum chores. In this chapter, we will show you how your computer can help with these chores.

We will start with that boon to secretaries and writers – the word processing system. If you write anything – letters, reports, articles, books – word processing can be a big time saver. For example, have you ever written a letter, had it typed, and then found something you wanted to change? With a typewriter it usually means typing the entire letter over, and reproofing everything. With a word processor, making a change is just a minor adjustment. Word processors let you store a copy of the letter on a cassette or disk. Changes involve no more than loading the letter back into the computer's memory (from the disk or cassette), making your changes, and printing another copy. The same procedure is used to revise and update reports, articles, and chapters.

To give you a brief overview of word processing, we will describe a typical system. In Chapter Four, we described briefly the ISSI computer system and its general business programs. We will continue to use it here as an example since it combines word processing and business package capability. The ISSI "Word Factory" produces printed pages from a text pages can be formatted by the user in a variety of ways. The computer can be told to automatically number pages, add a heading to each page, or create a table of contents automatically, to name a few capabilities.

You use the system by operating a series of special function keys which are on the keyboard in addition to the standard typist keys. The function keys are used to tell the computer to do all sorts of things to the material displayed on the video screen. The screen itself has a little flashing line on it called the CURSOR. As it blinks cheerily at you it also tells you where anything you type into the machine will appear on the screen. As you begin work it will be in the upper left corner of the screen.

We don't want to overload you with this discussion of word processing. But we would like to briefly describe a few function keys that you might find interesting. (Remember, these functions are for the ISSI "Word Factory." Most good word processors will have similar functions but they may have different names or operate in a slightly different fashion.)

SCROLL UP and **SCROLL DOWN.** Most word processors can only display a few lines (16, 24, or 30) of a document on the screen at a time. When you use the scroll up key, your document begins moving up slowly one line at a time. It seems to "scroll" with the top line disappearing off the screen and a new line appearing at the bottom of the screen. The scroll down key makes the document go in the opposite direction. Actually, the ISSI Word Factory is again unique in its price range since it employs a "smooth scroll" as opposed to the usual; more jerky kind.

HOME. If you've been working on a document for quite a while and want to get back to the beginning of the document, just press the **HOME** key. The first page of the document will appear on the screen.

LAST. Similar to **HOME** but this key puts the last page on the screen.

HELP! This key explains the use of each of the other function keys while you are actually working. Press it and an explanation of the use of the function key is displayed on the screen. This is, again, an ISSI innovation.

GLOBAL SEARCH. This key allows you to search through the document for a particular phrase or piece of information.

Let's assume that you have prepared a copy for a lengthy sales brochure. In this brochure you have stated that a jar of jelly is 89 cents. Then you find out that your new special price is 92 cents. You can easily correct this by telling the computer to change this price every time it finds "89," or request the machine to flag you each time an 89 appears, so you can decide whether to change it on an individual basis.

PRINT. This key allows you to print a copy of your document exactly as it appears on the video screen.

There are 33 other special keys that perform a variety of functions. You can eliminate forever the need to "cut and paste." Even more important, you can spend your time writing rather than typing, cutting, pasting, copying, etc. The computer will do all these things for you. In addition, you need to proof only changes, not the entire text.

Now let's turn our attention to some other professional uses of computers. If you are a manager, your computer can act as a promotional tool by writing individual-looking documents personalized to each client by means of the name list. The machine will store that name list so you can update it next month. Also you can use a computer to perform some of your analyses, such as overseeing cash flow.

In these recessionary and inflationary times, cash flow is a major concern of both managers of small businesses and departmental managers of large businesses. Cash flow is important because it can be critical in day-to-day operations. But cash flow can be very complicated, and the exact cash flow requirements vary from business to business. Here are some general factors that need to be considered when doing a cash flow analysis. (You may want to add a few of your own.)

Accounts Receivable

1. What percentage of the accounts receivable fall into the various aging categories? For example, you may have 20% that are less than 30 days, 30% that are 30-60 days, 30% that are 60-90 days, and 20% that are over 90 days.
2. Is your business seasonal?
3. What is the payment history of your customers?
   Has it changed in the last six months or year?
4. What is the general payment pattern in your industry?

Accounts Payable

1. Is there a discount for early payment?
2. How often do you make payments?
3. Do any of your suppliers charge interest?
4. Can you make partial payments when necessary?

Sales

1. Are sales projections accurate?
2. Are sales made to the same customers or are new customers constantly being added and old customers being dropped?
3. What are your terms?

General Overhead

1. What are your fixed expenses?
2. Is your payroll fixed or variable?
3. Can some of your fixed expenses be paid quarterly rather than monthly?

Banking

1. At what rate do you borrow money?
2. Can you increase your revenue by using savings accounts?

All of these factors – and quite a few more – can be reduced to percentages. You probably do something like that now. If you are not using a computer, you probably take many hours *and* sometimes you are still off by quite a bit. With a computer, not only can you make more accurate forecasts, but you can also experiment with a wide variety of scenarios. Most managers like to think through, "What would happen if - -." Your computer can give you this capability.

One of the key elements of the cash flow projection is the sales forecast. This projection is usually made by the sales manager or marketing manager. If you are a sales manager, your real interest is in people, not a bunch of numbers on a piece of paper. Most sales managers think of sales projection as absolute drudgery. The forecasts are part of the job, so they are done. (How often have you said, "If I didn't have to do this – expletive deleted – I could spend my time generating sales instead of talking about them.") Well, we have some good news and some bad news. The bad news is you are still going to have to make out reports and do forecasts. The good news is your computer will make it easier. Think about this. Isn't most of what you project based on "educated guessing"? Obviously, a computer can handle numbers; all you have to do is tell it which ones.

Perhaps you are not a manager, but you would like to be one. What can a computer do for you? We will limit our nonmanager discussion to the largest professional group in the industry. This group is not doctors, lawyers, or teachers – it's salespeople. How can you use a computer in a sales job? First of all, you can use it for everything your manager does. Not only will you be able to produce better reports, but you will be gaining some valuable experience. Next, you can keep your tickler file on your computer. (A tickler file is a list of your customers, along with some pertinent information about each one.) You can also keep a product file on your computer. For instance, a real estate agent might have his or her list of current prospects on one disk and a list of houses on another disk. The customer list can give the prospect's name, the type of house he is looking for, how much he wants to pay, what neighborhood he prefers, etc. The house list can have all the same information broken down into similar categories. All the agent has to do is check both lists.

We could describe an almost endless variety of professions and show you how to use a computer to increase productivity in each. We won't do that. We *will* say, though, that regardless of your profession, there is probably some way you can use a computer to improve the quality of your work and free up more of your time.

Before we end our discussion of the professional uses of computers, we would like to tell you about a couple of computers. If you can't afford to spend about $10,000 or so for a machine like the ISSI system discussed before, but you would still like to do many of the things we discussed in this chapter, you will want to look at the AIM-65. This "low-end" professional computer can do many things except word processing, and it costs less than $600.00. Manufactured by Rockwell for engineers, scientists, and other professionals, it has some features that most "personal" computers don't have. It does, however, require some technical knowledge.

If you want to spend some money on a professional computer, the HP-85 is hard to beat. For $4,000.00, you will get a computer that will do everything we mentioned and a lot more.

AIM-65

One of the really nice things about Hewlett Packard's HP-85 is its graphics. Graphics can help you turn voluminous and difficult-to-analyze data into meaningful output. With the HP-85 graphics statements, you can draw graphs and plots and a lot of other things (including music – maestro!). HP sells a series of plug-in programs for everything from cash flow to regression analysis.

HP-85

We hope you will use your computer to stave off recession, whip inflation, progress in business, write books, analyze investments, or just have fun. Whatever your use, you'll find a computer a worthwhile investment.

Chapter 6

It's Not Magic: The Basic Computer

When we first became interested in computers we read everything we could on the way computers work. We learned about computer memories, about the signals that go out on parallel ports, about handshaking, UARTS, RAM, ROM, integrated circuits, system clocks, data registers, and much more. This interest in the nuts and bolts of computers is reflected in Jerry's book, *Peanut Butter and Jelly Guide to Computers*. The plain fact of the matter, however, is that you don't really have to know much about what goes on inside a computer to use it, just as you don't have to know a lot about video tape machines or microwave ovens to use them.

It's nice to know how to build your own accessories for the computer and how to troubleshoot problems when they occur. But gaining that much knowledge takes a great deal of time and effort – effort which might be better invested in something else, such as learning how to program the computer. Then you would be able to write or customize your own software. Our advice is to learn a little bit about hardware so you can carry on idle conversation at a party. Then concentrate on learning the software side of computing. Finally, after you've become proficient at programming in a computer language or two, go back to the hardware and dig a little deeper. For most people, developing software skills pays off quicker. There is so much that can be done, and even a little knowledge of a popular language like BASIC can be of great benefit. Many people, in fact, will probably never get too involved in hardware. They will, instead, invest learning time in sharpening their software expertise. This makes a great deal of sense. Technological advances in computer hardware can make much of what you've learned obsolete in a very short time. This is less likely to happen to a person who has learned to program a computer. Programming or software knowledge is also more portable than hardware knowledge. If you learn to program an Apple or North Star computer in BASIC and PASCAL it should not be that difficult to switch to an improved model or to a new system which also uses BASIC and PASCAL.

The remainder of this chapter presents a brief overview of a typical computer system. If this introduction to hardware only whets your appetite, the dilithium Press catalog contains a number of books which concentrate on computer hardware.

A SIMPLE COMPUTER SYSTEM

Figure 6-l diagrams a typical entry-level computer system. While the printer may be a bit of an extravagance for the beginner, it is an absolute necessity for anyone who plans to use the computer for word processing or business applications. Computer systems from several manufacturers include all of the components shown opposite, except the printer. In some cases the video monitor and the tape recorder are "optional" accessories. Since you must have a monitor and a recorder, however, to use the computer, they really aren't optional – they just cost extra. Let's take a look at each of the components that makes up a small computer system.

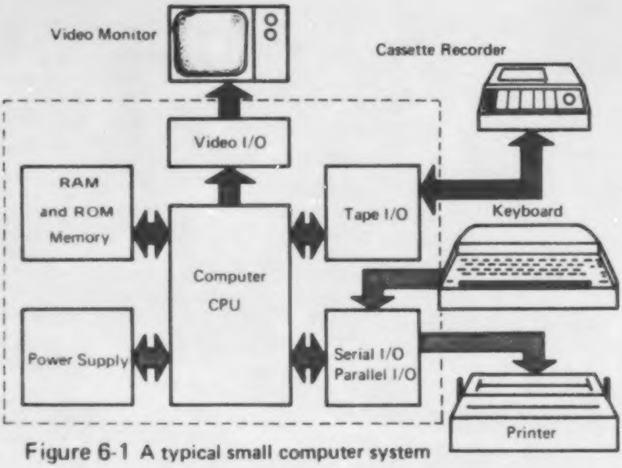
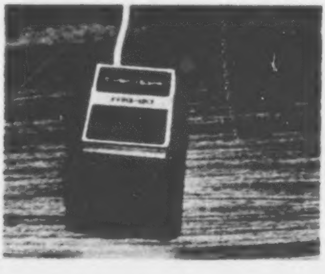

Video Monitor
Cassette Recorder
Video I/O
RAM
and ROM
Memory
Tape I/O
Keyboard
Computer
CPU
Power Supply
Serial I/O
Parallel I/O
Printer

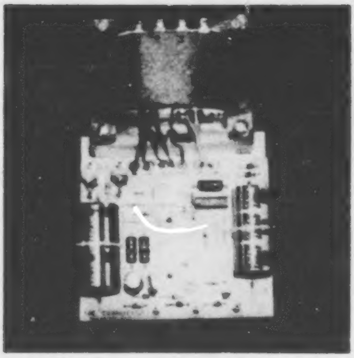
Figure 6-1 A typical small computer system

Power Supply

Not long ago power supplies for small computers were heavy brutes, designed to feed carefully filtered electrical energy to power-hungry circuits. Memory chips had particularly voracious appetities in the early microcomputers. Today memory technology has progressed to the point where small computers require very little power. This has allowed designers to build smaller, less expensive power supplies which do a good job. The power supply alone in the old Sol 20 computer, for example, weighed twice as much as two new TRS-80 computers and an Atari or two!



The TRS-80 power supply



A computer power supply

Most computer systems require at least two voltages, +5 and +12. Other voltages commonly used include -5 and -12 volts. The power supply takes the 115 volts AC (alternating current) from your wall plug and converts it to the DC (direct current) voltages required by the computer.

The power supply also does another job. If filters the line voltage so that a circuit that requires +5 volts gets just that, no more and no less. Power supplies which lack adequate filtering tend to have "ripple" in their output. This means that the voltage sent to the computer will average +5 volts but may actually waver or ripple above and below 5 volts. Ripple can cause major problems in a computer. Fluctuations in the power supply voltage can cause the system to malfunction or behave in an erratic manner.

Most of the current crop of computers have adequate power supplies. The Radio Shack TRS-80, like many others, has a simple power supply designed to provide power only for the computer itself. A few systems, usually those with higher price tags, have enough reserve capacity to drive additional accessories attached to the computer.

One more point should be made about power supplies. A large number of problems associated with the use of small computers in homes and businesses are due to line voltage fluctuations. Suppose, for example, that you have a very large central air conditioning unit on the same circuit as your computer. The computer may work flawlessly in the winter and work poorly or not at all in the summer. Line voltage may drop considerably when a heavy demand is placed on it. This phenomenon has become commonplace in many parts of the country and is known as "brownout." Few computer power supplies are designed to deal with extreme fluctuations in line voltages. There are, however, a number of companies that sell special transformers which maintain constant voltage. Though expensive, they may be the only way to obtain dependable operation from a computer in some environments.

A related problem that can drive a computer user up the wall is a power line "glitch." A glitch is a very brief spike of high voltage. Although the typical wall plug will provide around 115 volts, there are circumstances which may, for a thousandth of a second or so, produce several thousand volts in the line. The erratic operation of one of our computers was finally traced to a large motor which was used to move air in a chilled water air conditioning system. Each time the motor turned on it caused the line voltage to drop slightly. It turned out that the power supply in our computer could handle that. When the motor turned off, however, it created a collapsing electrical field which fed a high voltage spike, or glitch, back into the electrical wiring of the building. Since it lasted only a split second, the most anyone noticed was a bit of static on the radio. But even that brief instant of high voltage was anathema to the computer. The spike rode into the power supply on the power line and was fed into the computer where it managed to royally confuse things. Programs that were working perfectly suddenly ran amuck. An automtive parts supply company

YEIKS!
VOLTAGE
PEAKS

which was on the same power line as a welding shop experienced similar problems whenever the electrical welders were in use. Again, most computer power supplies are not designed to handle such a problem, but there are several brands of power line isolators on the market. They typically cost around $80 and can often cure glitchitis immediately.

Memory

Computers need quite a bit of memory or storage capability. All the instructions a computer follows, for example, must be stored somewhere in memory. Data to be analyzed is also usually stored in the computer's memory.

A computer's memory works much like a human memory. Information which will be used later is stored as electrical charges in memory "cells." There are actually tiny sections of silicon that can be charged by an electrical impulse. The memory of most computers is organized into "eight-bit bytes." A bit is simply a place where a single piece of data is stored. A computer can store one "bit" in each memory cell. A bit can be either a 1 ("on") or a 0 ("off"). Generally a cell that has an electrical charge in it is considered to be holding a "1" while a cell with no charge in it is a "0."

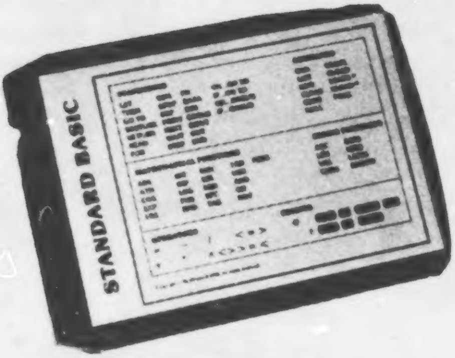
By themselves the lowly bits can't do much. To make them more useful they are combined into "bytes." This is a bit: 0, and this is a byte: 00110011. A byte is simply a set of eight bits. There are only two possible patterns for a bit: 1 and 0, but there are 256 possible patterns for a byte. Computers have been programmed to treat each pattern as a code which can stand for a letter, number, or instruction. Computer's can't deal directly with the letter A, but they can deal with a byte (a pattern of eight bits) which stands for A. The most commonly used code today is ASCII or American Standard Code for Information Interchange. The ASCII code for A is 01000001. Every upper and lower case letter, the numbers from 0 to 9, the most commonly used punctuation marks, and numerous computer control codes each has its own unique eight-bit code in ASCII.

Since the computer must deal with "eight-bit bytes" of data, the computer's memory is also organized into eight-bit bytes. If someone says their computer has "8K of memory" that translates into 8192 bytes of memory. The term K is an abbreviation for 1024. Thus 8K equals 8 × 1024 or 8192. Each byte of memory can hold the code for one letter or number. Since a typical, double-spaced, typewritten page will have less than 2000 characters on it, 8K of memory will hold at least four full pages. That really isn't much, which explains why many computers used for word processing have about 32K of memory, enough to hold over 16 pages.

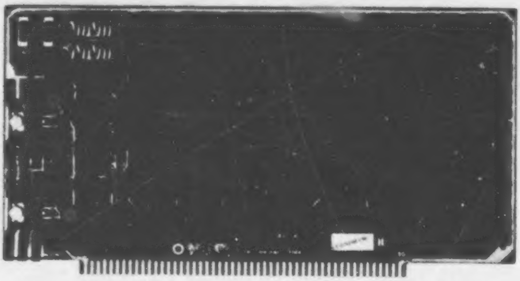
As Figure 6-l shows, there are two major types of memory, ROM and RAM. ROM stands for "read only memory." This kind of memory is generally programmed at the factory. The contents of ROM cannot be changed by the user. The Radio Shack computer, for example, stores the instructions for its version of BASIC in ROM. Other computer manufacturers sell much of their software in ROM. In computers like the Exidy Sorcerer, programs in ROM are packaged in a little plastic case that can be inserted into a slot on the side of the computer.

All computer memory cannot be ROM, however. Much of the memory in a computer is RAM. The average home computer will contain 16K of RAM while a business computer system often has 48K or more of RAM in addition to some ROM. Random access memory, RAM for short, is also known as "volatile" memory. It is general-purpose memory. You can store data or instructions in RAM, then tell the computer to use the information you've stored in RAM, and then replace the material in RAM with something new. The biggest problem with RAM is the fact that whatever is in it disappears when the computer is turned off. If you need to save something in RAM for use later, you must store it on tape or on a disk before the computer is shut down. (Material in ROM remains there essentially forever.)

A RAM chip



A Sorcerer "ROMPAC"



A computer memory board

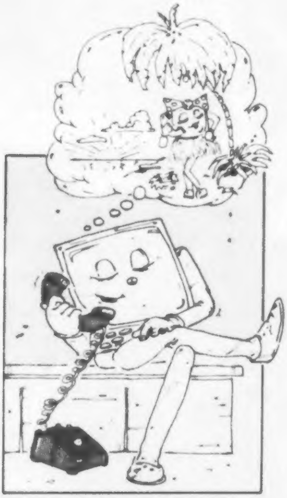
I/O Ports

A "port" is a sort of gate or entryway into the computer. Data flows into and out of the computer through a variety of I/O or input/output ports. These ports generally consist of some electronic circuits and a plug or connection that mates the computer with another device such as a printer or a television screen.

Video Display Ports. It requires quite a bit of hardware and software to display the data stored in a computer's memory in orderly rows on a video screen. Most computers will display at least 16 lines of 64 characters on the screen of a converted television or a monitor. Most also permit the user to display a variety of graphic figures and symbols. Graphic figures can be combined to create pictures, charts, and illustrations. Some computers have special circuits that give them very sophisticated graphics features.

Cassette I/O. The least expensive method of storing computer data is a good tape recorder. All the major small computers currently available have built-in cassette I/O features. The cassette system converts all the little ASCII bits and bytes into tones which are stored on tape. To put this taped data back into the computer you reverse the process. The tones on the tape are converted back into "1's" and "0's", collected into bytes, and stored in RAM locations.

Serial and Parallel I/O. There are two types of "general purpose" I/O ports in small computers. These ports are called parallel and serial. A parallel port has a wire or connection for each of the eight bits in a byte of data. If you tell the computer to send a byte out the parallel port to a printer, the eight bits in a byte are all shipped out to the printer at the same time over eight different lines. Input from the keyboard to the computer is also generally through a parallel port.



Serial I/O ports work a bit differently from parallel ports. When eight bits of data arrive at a serial port they don't all leave at the same time. Instead the first bit in a byte is sent out on one line, then the next bit goes out on the same line, and so on. All the bits in each byte march out of the computer (or into the computer) over the same line. Any work that involves transmitting data over telephone lines will use a serial port.

The term "baud rate" is often used in relation to serial ports. Telephone couplers generally work at a speed of "300 baud." Simply defined, a baud rate of 300 is equivalent to a speed of around 350 words per minute. Last year we bought a small printer that could be connected to a serial I/O port. Since our computers all had serial I/O ports we assumed it would plug right in. Unfortunately the fine print in the printer manual told us it accepted data only at a speed of 600 baud while several of our computers transmitted at 300 or 1200, but not 600. Like the man said, let the buyer beware.

CPU

The CPU, or central processing unit, is the heart of a computer system. Although most CPU chips are smaller than an Oreo cookie, the electronic components they contain would have filled a room a few decades ago. Using advanced microelectronic techniques, manufacturers can cram thousands of circuits into tiny layered silicon chips that work dependably, and use less power than an electric razor. There are several manufacturers of CPU chips. Intel makes the 8080, the 8085, and several others. Zilog makes the Z80 and the Z-8000, Motorola makes the 6800, and MOS Technology makes the 6502. While there are real differences among the CPU chips mentioned above, the differences are mainly of interest to computer designers and experienced programmers. You can work with your computer a long time without even knowing which chip it uses. (Do you know what type of engine you have in your car? You don't need to know anything about the internal workings of your computer either.)

Regardless of the chip the CPU does all the actual processing inside the computer. It also sends signals to the other parts of the computer which synchronize the operation of each component. This synchronization permits the system to perform thousands of operations a second. These operations are fairly simple (e.g. adding two numbers together) but the speed at which they are done allows the computer to do some very complex things by breaking complicated jobs into hundreds of simple steps.

A CPU chip

Again, if this brief introduction to computer hardware has caught your interest, there are several very good books in the dilithium catalog which provide more information.

Chapter 7

The Current Crop

We subscribe to over 20 computer periodicals and attend our share of conventions, conferences, and trade shows. A rough guess would be that through these various outlets computer manufacturers announce two or three new systems a month. The companies that offer these new machines to the public range in size from billion dollar conglomerates to one-person operations occupying one side of a two-car garage. The products offered enter a marketplace where there is already available a large assortment of equipment. The abundance makes choosing a computer difficult but it also means that when you want to buy a computer you are more likely to find a system that fits your needs.

During 1979-81 there were, to be sure, some failures in the small computer marketplace. Names like MITS, IMSAI, Digital Group, Sphere, and Processor Technology are gone now. But for every computer manufacturer that disappeared, at least four or five new players tossed their chips into the pot. Names like Atari, Sinclair, Sylvania, Mattell, Quasar, Sharp, Micro-Expander, Matsushita, and Texas Instruments are heard more and more often these days.

Before we can discuss the currently available computers, we need to define some terms. If you have read the first six chapters, you should know them. However, we thought you might like to have a handy reference, so put your thumb right here. We will present the terms in the same order that they are used in the system descriptions.

Video Display. This is the screen on the computer. If a display is 16 X 32, it can display 16 lines, each of which can be up to 32 characters long. Remember that spaces, periods, commas, etc. are all characters.

Keyboard. We may refer to a keyboard as a standard, full-size with a QWERTY format. This means that it is about the size of a standard typewriter keyboard and the key arrangement is the same. (Please note that QWERTY refers to the layout of the third row of keys–QWERTYUIOP.) A keyboard may also have a separate numeric keypad. This is a separate set of keys laid out in standard calculator fashion. The keypad is very important if you plan to use the computer for business or educational applications.

Chip Used. This is the actual microprocessor used in the computer. You will probably never need this information but it can be very helpful in certain circumstances. For instance, you may want to buy an accessory that is available only for "Z-80-based machines." If the accessory is your primary reason for wanting a computer, then you will want to be sure you buy a computer with a Z-80 chip.

Languages Used. There are the programming languages available for use on the computer. Examples include BASIC, PASCAL, assembler, FORTRAN, and several others. If you plan to write many of your own programs you will want to pick a computer with a language you can use.

Storage. This is the method available for saving your programs. Most computers have a cassette tape interface or a floppy disk interface; many have both.

ROM Software. This is software available for the computer in preprogrammed ROMs. Some computers have optional languages available in ROM; a few also have applications software available in this format.

Software. This refers to the amount of canned software available for the computer. If you don't plan on writing your own programs, you will want a system with lots of software available from the manufacturer and independent software developers.

I/O Ports. These are the number of input/output ports available for connecting the computer to various peripherals. If you plan a large system, a computer supplied with lots of serial and parallel I/O ports can save you money.

Service. This refers to the system design in terms of likeliness of repairs and the prospects of getting your computer fixed when necessary.

HMM.........
I THINK.....
THEREFORE
I AM.......
DE DE DUM..

The job of selecting a computer is the topic of several other chapters. Here we will concentrate on describing the most popular computers on the market today. We can't possibly cover all the several hundred models. So we've chosen systems that cost between $200 and $4,000 and comprise well over 97% of the small computer market. Let's start with the machines from the company that has sold more computers than anyone, Tandy Corporation.

THE RADIO SHACK COMPUTERS

There are currently five computers in Radio Shack stores. Although the venerable Model I went out of production in 1981, there are more Model I computers in the hands of consumers than any other kind. The Sunday classified sections of papers in most major cities usually have at least one or two Model I's for sale, often at very attractive prices.

TRS-80 Model I

Video Display. This model shows 16 lines of 64 characters, or 16 by 32 black and white, with crude graphics possible. Only capital letters are displayed unless an optional lower case modifiction is installed.

TRS-80 Model I

Keyboard. It has a full size, typewriter style keyboard. Current production models are excellent, older models are terrible—too much keybounce. Numeric keypad is optional.

Chip Used. Z80.

RAM. The system comes with a minimum of 4K RAM. Up to 16K can be installed inside the keyboard. Another 32K can be placed inside the optional Expansion Interface.

Languages Used. A version of Tiny BASIC dubbed Level I BASIC is supplied in the least expensive Model I ($500). Almost everyone uses the optional Level II language. Level II BASIC is a version of Microsoft BASIC and is excellent. In addition, virtually every general purpose computer language has been adapted for use on the Model I. FORTRAN, COBOL, PILOT, PASCAL, and many others can be purchased from a variety of vendors.

Storage. All versions can use a standard cassette recorder to store programs and data. The cassette system on this computer however, is one of the worst, even with the circuit revisions and upgrading kits provided by Radio Shack. It is not that fast either. Many vendors offer 5¼-inch disk storage systems for the Model I. They seem to work well and turn the computer into a very good unit for small business and professional use.

ROM Software. Only BASIC and some operating system software are supplied in ROM.

Software. There is more software available for the Model I than for any other computer. The variety of software available is the strongest selling point.

I/O Ports. There are no standard ports for serial or parallel devices such as printers or modems. They are all options that cost extra.

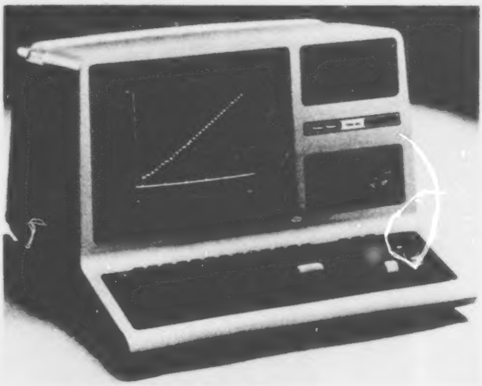
Service. Regional repair centers across the country seem to do a good job. Yearly service contracts are available.

The Model I is both praised and damned by those who use it. The system is actually a collection of four major pieces: a computer/keyboard unit, a video monitor, a power supply pack, and a tape recorder. Then there are the cables that connect all these separate pieces together. It is hard to make a Model I installation look neat and tidy. The cassette storage system is probably the weakest aspect of the system while software support is the strongest. Prices start at about $500.00

TRS-80 Model III

You could say that the Model III is what the Model I should have been in the first place. Everything except the cassette recorder is in one case and there is even space for two disk drives. Even the cassette recorder is improved. It loads and saves programs faster and more dependably than the Model I ever did. The Model III is generally software-compatible with the Model I. A BASIC program written for the Model I will usually run on the Model III with little or no modification. That means there is a gigantic software base already available for this computer.

Much of the description of the Model III is a repeat of what you read about the Model I. There are some nice differences, however. On the Model III the ability to display lower case letters is standard and the display can be manipulated in ways not possible on the Model I. The keyboard is excellent and includes a numeric keypad. A parallel printer port is also standard as is a "real-time clock" that can keep track of elapsed time during the operation of the computer (useful in some game programs and also used in some business software).



TRS-80 Model III

The Model III will support up to four disk drives, as will the Model I, but the actual storage capacity is more than double. Whereas a 5¼-inch disk in a standard Model I system could store around 58K on a disk (in a one-drive system), the Model III can store 135K. In addition, the disk operating software used with the Model III is expanded and improved. The difference in price between a Model I and Model III equipped with the same equipment amounts to at least several hundred dollars. If you can afford it, that difference is probably worth the money.

TRS-80 Color Computer

Video Display. Display includes 16 lines of 32 characters, capitals only, color. Limited color graphics are possible with the standard BASIC supplied with the computer; more sophisticated color graphics features come with the extra-cost BASIC. The $399 computer attaches to your color television and uses either channel 3 or 4. Sharpness and clarity are good but not outstanding.

Keyboard. The system uses a standard typewriter format, but the keyboard is slightly smaller than a regular keyboard.

TRS-80 Color Computer

Chip Used. 6809 from Motorola.

RAM. 4K of RAM is standard; more can be added.

Languages Used. An 8K BASIC designed by Microsoft is provided in ROM. A more sophisticated BASIC is available as an extra-cost option.

ROM Software. BASIC is in ROM. Games and home/business programs are available in ROM cartridges that plug into the machine.

Storage. At present only cassette storage is available. However, disk systems are planned for the future. The cassette system loads programs fast and appears to work well.

Software. This is currently a weak point. The TRS-80 color computer is not compatible with any other computer. Thus there is no established software base. Few programs are available on cassette, and Radio Shack has been slow in providing a selection of program cartridges. This area must be improved for the TRS-80 color computer to be competitive.

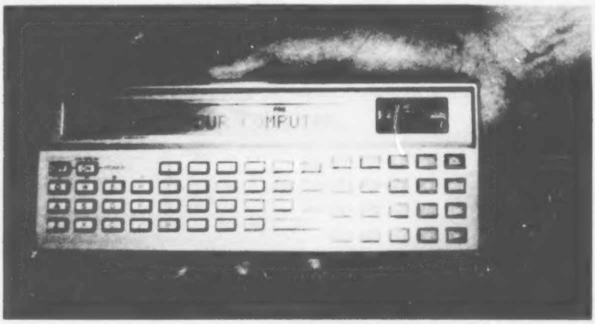
I/O Ports. A serial port is standard, as are the two "joystick" connectors used in many games. There is also a way of generating tones through the television speaker—another nice feature for games.

Service. Same as other Radio Shack computers.

The TRS-80 Color Computer is one of the newest additions to the Tandy/Radio Shack line. Like the Model III, everything except the tape recorder is in one attractive case. It is what some people call a "consumer" computer. That is, you can buy it, take it home, and plug it in. Program cartridges are inserted in a slot on the side of the computer so you don't even need to load software in from tape or disk. The TRS-80 Color Computer is competition for computers like the Atari 400 and the APF computer. Program cartridges are likely to concentrate on games, home/financial applications, and some educational software. The TRS-80 Color Computer can be programmed in BASIC, but many people who buy it will probably find writing their own programs more trouble than they care for.

TRS-80 Pocket Computer

This is a truly unique computer. It looks a lot like an overgrown calculator, but it is much more than that. The TRS-80 Pocket Computer is a handheld machine that can be programmed in BASIC. It has a calculator-style keyboard that includes all the letters of the alphabet arranged just like a typewriter keyboard. A numeric keypad is to the right of the letter keys.



TRS-80 Pocket Computer

People with fat fingers will have trouble with this keyboard. There is also a small liquid crystal display which has room for one line of 24 characters.

Smallness, however, is the main drawing card of this computer. It fits in your pocket and runs for around 300 hours on one set of mercury batteries. The RAM memory in the system (1.9K available to the user) is kept on standby when the computer itself is turned off. That means a program you put into memory is not lost when the machine is switched off. The computer itself costs $250 and a cassette interface is $50 more (not including the cassette recorder).

Some people have criticized this computer, calling it a toy or a joke. It is true that it won't balance your books or help you write the great American computer book. By the same token, a regular-size computer couldn't take the place of a five million dollar mainframe system. However, if you are one of those people who need a small, portable, programmable computer then this is for you. A pilot, a construction engineer and a real estate salesperson all come to mind, and Radio Shack has inexpensive software packages for each. There are also "math drill" programs and a cassette of games. An application that does not require portability, however, would probably be better served by other computers.

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COMPUTER
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BATTERIES EXTRA
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The TRS-80 Pocket Computer is actually manufactured by Sharp Electronics in Japan. Sharp is expected to begin U.S. marketing of the computer under its own name in 1981 or 82. Several other Japanese electronics firms are also gearing up for the U.S. market.

TRS-80 Model II

Video Display. This model shows 24 lines of 80 characters, upper and lower case, black and white. A format of 24 lines by 40 large characters can also be used. There are no graphics. The Model II comes with its own excellent built-in display.

Keyboard. This business-oriented computer uses a standard typewriter-style keyboard. It is one of the best keyboards available for small computers. A numeric keypad is standard.

Chip Used. Z80.

RAM. 32K is standard, 64K is optional.

Languages Used. The Model II comes with a sophisticated BASIC that uses 8-inch floppy disks for data and program storage. FORTRAN, COBOL, PASCAL and virtually every other major computer language are also available for the Model II. All of these langauges are on disks; at the present time nothing is avaible in ROM.

ROM Software. Because the Model II is oriented toward disk storage there is no user software in ROM with the exception of enough "smarts" to allow the computer to load in programs from a disk.

Storage. One 8-inch disk drive housed beside the monitor in the main computer cabinet is standard. Up to three others can be added in another cabinet. Each disk can store just under half a million bytes of data. In a one-drive system, however, 77K of storage is required on each disk for the disk operating system software and BASIC. Only 23K of storage space is taken up on the second, third, and fourth disks, leaving 470K on each disk for program and data storage. There is no provision for cassette storage nor should there be with 8-inch disk drives.

Software. There is a large amount of business and professional software for the Model II. Several games are also available, but it would be hard to justify buying a $3500 computer just to play games. Many small businesses are buying this computer because it has so much software available for it.

I/O Ports. One parallel and two serial ports are standard on the Model II. It is relatively easy to connect printers and modems. In addition, Radio Shack supplies several types of software that help the user talk to printers, modems, and mainframe computers.

TRS-80 Model II

Service. Same as other Radio Shack computers.

The Model II was designed for computing jobs that need more computing power than a Model I or III but aren't big enough to justify a minicomputer or a mainframe. It is a relatively reliable system that does the work of a business or professional computer quite nicely. The only drawback is its cost, but most people who buy this system are not looking at $800 systems as alternatives. Instead they consider the Model II along with $12,000 to $30,000 minicomputers. In that comparison the Model II doesn't look bad at all. A particularly strong point for this computer is the number of companies writing software for it. An owner is not tied to one supplier for software, and can buy accessories and peripherals from many sources as well.

Several excellent word processing packages are available for the Model II which allow it to duplicate or improve on the functions of a $20,000 dedicated word processing system.

ATARI 400 AND 800 COMPUTERS

Video Display. 24 lines of 40 upper and lower case characters and excellent color graphics are features of this system. The Atari computers use a regular color television or color monitor for display.

Keyboard. Both the 400 and 800 use a standard-size typewriter layout. The 800's keyboard is much like that on several other computers and is good. The 400 uses a flat membrane-type keyboard that is "touch sensitive." The 400 beeps each time you press a key hard enough to register your response. Many people find this type of keyboard hard to get used to, but it is an inexpensive and effective way of providing a full-size keyboard. Neither computer has a separate numeric keypad.

Chip Used. 6502

RAM. 16K is standard. The 800 can be expanded to 48K while the 400 can only be expanded to 32K.

Atari 400 Computer

Languages Used. Both can be programmed in a version of BASIC when the BASIC language cartridge is plugged into the machine. Microsoft BASIC is also available in a ROM cartridge. In addition to the BASIC cartridges, Atari offers a ROM cartridge that allows you to program the computer in 6502 assembly language.

Atari 800 Computer

ROM Software. Atari now has a wide range of program cartridges for their computers. They plug into slots on the top of the machine. Games, home, small business, and educational programs are all available. Those who want to use a computer rather than program it will find the Ataris interesting. There are many high school and college-level educational programs available for use on the Atari. BASIC is not permanently installed in the computer but is in one of the cartridges that plugs into it.

Storage. Both models have standard cassette storage facilities that work reliably. The cassette recorder itself is not included in the price of the 400. Optional 5¼-inch disk drives can be added to either machine.

Software. Much of the software for the Atari is supplied in ROM cartridges. There are also many programs on cassette. That means the software will be easier to load into the computer (just plug in the cartridge).

I/O Ports. Game paddle ports are standard. Parallel and serial ports for modems and printers are optional. Atari offers a wide range of peripherals for their systems (e.g. a light pen accessory and several types of printers).

Service. The machines are serviced through an agreement with the regional repair centers of Control Data Corporation. Atari also has a comprehensive dealer training program that includes dealer service.

Atari is a dominant force in the electronic game field. Their products are easy to use, sophisticated, and available everywhere. Using that base of experience Atari moved into the small computer market in 1979 with two models–the 400 and the 800. The electronic game ancestry shows in these computers. The display is in brilliant color, the graphics are excellent, and there is sound. The Atari was designed primarily for the home market with a secondary concern for small business applications. It is a very competitive system that is appropriate for managerial applications and some small business applications. It is especially suitable for a family wanting a recreational computer that can be used for more serious applications as well. Both are heavily discounted by some mail order suppliers. The Atari computer line is also sold in Sears stores and catalogs.

APF IMAGINATION MACHINE

Video Display. This system shows 16 lines of 32 characters. Several levels of color graphics can be used which range from rather crude to good. The APF computer uses your color television for video displays.

Keyboard. A typewriter-style keyboard which has a good feel (53 keys, no separate number pad) is standard. In addition, there are two game controllers which have "click" type keys and joystick knobs. These separate controllers make the system very effective as a recreational computer.

Chip Used. 6805.

RAM. 9K is standard; another 8K can be put in an optional expansion box.

Languages Used. APF supplies a nonstandard BASIC that differs on several points from the Microsoft BASICs most programmers are accustomed to. Translating programs from other versions will be difficult in some cases.

ROM Software. BASIC is in ROM as are several types of games. More ROM software which can be plugged into the machine should become available after the machine gains market acceptance. Perhaps the word "after" should be changed to "if" since it is not at all clear whether this computer will be commercially successful.

Storage. There is a cassette recorder built into the computer on the right side of the keyboard. Some users have reported problems with this part of the $599 APF machine. A $995 version includes a 5¼-inch disk drive and printer/modem connections.

Software. In addition to the games in ROM cartridges, APF also sells quite a bit of software on cassettes. These include educational programs (e.g. a program that teaches touch typing), games, and personal finance programs (e.g. a checkbook balancing program).

I/O Ports. Not much is provided in the standard machine but options permit the user to plug in printers, modems, and a floppy disk. It does have the ability to create simple computer music through a built-in speaker.

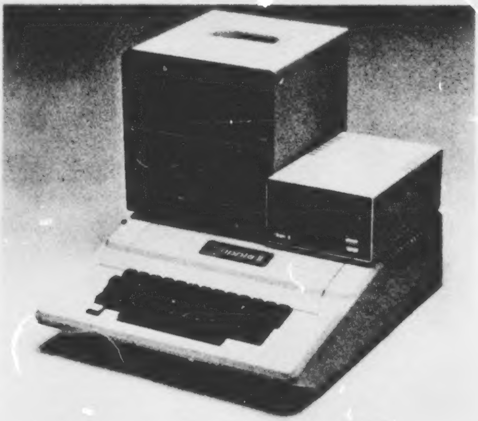
Service. No information on this.

APF Electronics manufactures an electronic game which serves as the foundation for their computer. The game unit fits into a depression on the computer keyboard case and has slots for software cartridges. The main marketing thrust of APF is toward the home market. Even the educational programs seem designed for use in the home rather than at school. It is an adequate computer for beginners with no interest in business or professional use, but unless APF is able to increase the amount of software available for this system, it's market position is likely to be eroded by machines like the Atari computers.

APPLE

Apple II

Video Display. 24 lines by 40 characters (upper case only) are displayed. Several levels of color graphics can be used, with quality ranging from crude to very good. The Apple II uses your color television (requires extra-cost modulator) or color monitor as its display. Several companies offer optional circuits that display 80-character lines and thus make the Apple II suitable for word processing.



Apple II Computer System

Keyboard. The system uses a standard typewriter-style keyboard of good quality.

Chip Used. 6502.

RAM. 4K is standard; expansion to 48K is possible by plugging extra memory cards into slots inside the case.

Languages Used. Apple offers several versions of BASIC in ROM and other languages such as PASCAL and PILOT are also available as are machine and assembly language capabilities.

ROM Software. BASIC is provided in ROM.

Storage. The standard Apple II uses regular cassettes for storage. The system is relatively reliable—you supply the recorder. A disk system is also available.

Software. The Apple II is the second best selling computer today (behind the TRS-80 Model I). Its popularity has prompted many programmers to write or adapt software for it. There are hundreds of business, home, recreational, and educational programs for the Apple II. Bell and Howell Corporation has entered into an agreement with Apple and will support the Apple II in the school market. Because is can display color graphics, the Apple II is being used extensively in educational settings.

I/O Ports. Four game paddle ports are standard; two paddles are provided. The computer can also create simple sounds through a speaker in the computer. Optional cards plug into slots on the computer to provide ports for printers, modems, and disk drives. Several companies, in addition to Apple itself, specialize in building accessories for the Apple II. There is a great deal of sophisticated equipment for this computer including music synthesizers and home environmental and security controllers.

Service. Apple has had some difficulty in this area. They have set up a satisfactory system of regional and local repair depots centered in successful computer stores.

The Apple II has been a very successful computer. It brought the Apple Computer Company from facilities in part of a rented garage to the status of a multimillion dollar corporation whose stock sells on a major exchange. The system is best suited for educational and home applications. Business applications are also possible but they may require the user to buy quite a bit of additional equipment. Excellent documentation, strong factory support and an enormous software base are all Apple characteristics. It wasn't long ago that Apple had its segment of the market all to itself. Now several new computer systems appear aimed directly at the prospective Apple buyer, but the Apple II is still a system to consider carefully.

Apple III

Video Display. The systems displays lines of 80 characters, upper and lower case, black and white. A black and white monitor is provided. The system will also support 40 character lines in color, but you have to supply the color monitor or television. Color graphics like that on the Apple II are also possible. In addition, it is possible to program the Apple III to display different character sets including non-English alphabets.

Apple III Computer System

Keyboard. A high quality standard keyboard is provided which includes a numeric keypad. A word processing version of the Apple III has control and editing functions printed on the keys to make it easier to use. The function of the 74 keys on the keyboard can also be changed in software, making specialized programming applications easier. It is one of the better keyboards on a small computer.

Chip Used. A descendant of the 6502.

RAM. 96K RAM is standard; it can be expanded to 128K RAM. Note that most other computers reviewed in this chapter can accept a maximum of 48K or 64K RAM. Many business and professional users will find the ability to put over 100K of data in this computer to be a major selling point.

Languages Used. It will run a variety of languages including FORTRAN, PASCAL, and a "Business BASIC" developed specifically for this computer. To some extent these languages can be used cooperatively on the Apple III (e.g. create a file in one language, process it in another).

ROM Software. This is a disk-oriented system with very little software in ROM.

Storage. The Apple III has one 5¼-inch disk drive built into the case. Three more can be added.

Software. The Apple III will run software written for the Apple II which means a great deal of software already exists for it. The new software designed specifically for the Apple III will primarily be business and professional programs. Apple offers a very good word processing package, for example.

I/O Ports. It uses the same format as the Apple II. Equipment that attaches to the Apple II should easily connect to the Apple III using the same interface cards. Two serial ports are included in the base price. In addition, there is a sound synthesizer which can be programmed to generate music and voicelike sounds.

Service. Same as Apple II.

This little computer has a base price of $4340 and it can easily take over $8000 to set up a complete system which includes a printer and software. It is designed for a segment of the small business and professional market which lies above the upper limits of the Apple II. Be sure you need everything it offers before writing the check.

EXIDY SORCERER

Video Display. The Sorcerer displays 24 lines of 64 upper-lower case characters. You supply your own monitor or pay extra for one. The video output is black and white, but the system is capable of producing good quality graphics. The Sorcerer has 128 standard graphics symbols in memory and the user can define 128 additional symbols. Japanese and Russian character sets have been created for this computer.

Keyboard. The keyboard is a standard typewriter style of good quality. A separate numeric keypad is standard.

Chip Used. Z80.

RAM. This system supplies 16K of RAM and sockets for an additional 32K are inside the computer. Exidy also offers an expansion chassis with slots for memory boards which use the S-100 design format. This type of memory board, however, is expensive to buy. It would be much cheaper to simply buy the chips and plug them into the sockets on the Sorcerer's main printed circuit board.

Languages Used. A mediocre Microsoft BASIC is supplied in ROM with the computer. A very powerful Microsoft BASIC is supplied on disk at extra cost. An "extended BASIC" is also available for cassette systems. Several disk systems for this computer are "CP/M compatible;" this means they use a software package called CP/M that configures the computer to run a wide range of "CP/M compatible" software. COBOL, FORTRAN and several other languages are thus available once you buy the CP/M package.

ROM Software. Exidy started as a major producer of electronic arcade games. That background is reflected in the way the computer is set up. Like the APF and the Atari systems, the Sorcerer has a slot for inserting programs stored in ROM. The Sorcerer, however, is not intended to be primarily a recreational computer. The standard BASIC language software for the computer is in a ROM cartridge as are programs for writing machine/assembly language programs and a word processing program.

Storage. The standard Sorcerer uses a fast and relatively reliable cassette storage system, and there is an optional disk system that is expensive but good. Vista Computers also sells a less expensive disk system for the Sorcerer. The North Star disk system can also be used if the user buys the S-100 expansion chassis for the Sorcerer.

Software. This computer is an also-ran. It is good enough to keep the division in business but not so fantastic that it has become a major seller. That means it has not attracted many independent programmers who could write applications software for it. And the Exidy people themselves have not been all that fast about producing software for their own system, and some of the software they have marketed has had problems.

The Exidy Sorcerer Computer system

I/O Ports. There is a parallel and a serial port at the back of the computer. An optional expansion interface permits the user to connect many different types of "S-100" peripherals to the Sorcerer as well (e.g. voice synthesizers, memory boards, disk systems, speech recognition equipment).

Service. It is supposed to be improving, but our experience with this company has been dismal. A Sorcerer that was defective had to be shipped back to the factory in California three times before it was fixed. On the last trip they "lost" the computer for several months while swearing it had been shipped back. Finally it was found sitting on their loading dock.

The Sorcerer is a well designed, compact, attractive computer. A 32K Sorcerer would sell for less than a 32K upper/lower case TRS-80 Model I with a serial and parallel port. You must supply your own monitor, but the Sorcerer is clearly a better designed, easier-to-use computer. Why then has the Model I TRS-80 outsold it by perhaps 100 to 1? The availability through thousands of stores of the TRS-80 is probably a factor, but that hasn't kept the Apple people from selling a lot of computers. The main problems with the Sorcerer seem to be inadequate factory support and a small software base for the system. If you have a reliable dealer for Sorcerers nearby (with their own service staff), and if there is software for the application you need, consider the Sorcerer.

Exidy recently set up its computer division as a separate company. The new company has excellent management so things should improve. As a professional and small business computer the Sorcerer has a lot of potential.

COMMODORE 2001 AND 8000 PET COMPUTERS

Video Display. The 2001 compuers have a 25 line by 40 character display with very good black and white graphics also available. The 8000 system is a business-oriented computer with a 25 line by 80 character display. All the Commodore PETs have a built-in monitor. One well-styled case contains the keyboard and the monitor.

Keyboard. Early PET 2001's had calculator-type keyboards that were a pain to work with. Newer 2001's are available with standard typewriter size keyboards that appear to work nicely. There is a separate numeric keypad. The 8000 models also have very good keyboards with several control keys provided.

RAM. A minimal system may have only 8K of RAM, but all the models can be expanded. In some instances you must buy the computer with extra memory installed by Commodore.

Commodore has been known to drill holes through the circuit board where extra memory chips could be installed. That prevents a user from buying the memory from a discount supplier and adding it to a PET. As far as we know Commodore is the only company that does this, and it is such an offensive business practice that I would think twice about buying a PET that has been permanently "crippled" at the factory.

Languages Used. A good Microsoft BASIC is in ROM in all models. The BASIC on the 8000 models has some additional features. Other languages are available from several vendors.

ROM Software. BASIC is in ROM. Applications software is supplied on cassette or disk. The software that runs the disk system, however, is also supplied in ROM and plugs into sockets on the main computer board. That makes using a disk much easier.

Chip Used. 6502.

Storage. Standard PETs use cassette storage. Early-model PETs had a built-in cassette recroder; current production models do not. In either case the recorder used is modified by Commodore to improve reliability. Standard audio cassettes are used for storage, however. The cassette storage system appears to work well on the PET and disk systems are also available as options.

Software. The PET line of computers follows closely behind Apple in terms of systems sold. There are enough of them out there to ensure that a large amount of recreational, educational, home, and business software has been generated for them.

I/O Ports. The PETs provide connections for memory expansion and for standard accessories such as printers. Commodore uses the IEEE-48 bus system for connection to external devices. This is a set of rules about how signals and data are transferred between different pieces of equipment. Commodore has done a good job of developing optional equipment that can be plugged into the PET. Their line includes several printers, a modem, disk drives, and a voice synthesizer. Good factory support is one of the positive features of the PET (old hands at the microcomputer game may argue this point because they remember times when factory support was less than good).

Service. We have had no direct experience with PET service facilities but have heard both very positive and somewhat negative reports. Local service is available in many cities.

The Commodore PET has been around for several years and is one of the best selling systems. The company started with one model and now has five or six basic versions that are designed to meet the needs of the small business market. The new CBM 8000 systems cost between $1500 and $1800. The 25 line by 80 character display makes this system a natural for word processing applications, and Commodore will be happy to provide you with a complete PET computer with disk drives, word processing software, and high-class printer. The 2001 PETs ($795) are more likely to be found in homes and in small business settings where word processing is not a high priority. Dependability, good factory support, software availability, and good documentation for the equipment are all PET strong points.

Currently Commodore has a special deal for educational institutions. If you buy two PETs they will give you a third one free! That is hard to pass up if you're at a high school, college, or even an elementary school and on the prowl for small computer systems.

OHIO SCIENTIFIC COMPUTERS

We won't provide a standard review of the Ohio Scientific line of computers since there are so many of them, but it would be a serious omission if they weren't mentioned. Over the past four years more than one competitor has been heard sounding the death knell of Ohio Scientific. The company is now one of the oldest (and surviving) small computer manufacturers, but it is not a company that has ever been in the spotlight. The early models had a crude look to them and Ohio Scientific was weak on software support and on dealers.

The Ohio Scientific line, however, is one of the broadest.

Their little Superboard II is a fully functional computer with a standard keyboard and a 24 line by 24 character video display that supports upper and lower case characters as well as graphics. The Superboard II costs $279 (a case is $50 extra) and requires a 5 volt (at 3 amps) power supply and a television for use. That makes the Superboard II one of the cheapest full-function small computers around. Ohio Scientific also sells a version with the case and power supply for around $350, and it is possible to buy this computer with a disk drive for well under a thousand dollars. Ohio Scientific finally has a decent selection of software with several nonfactory suppliers supporting the system as well.

Two higher priced series, the C4P series and the C8P series, offer such fancy features as color and 32 lines of 62 character displays. Ohio Scientific has been a leader in developing interface software and hardware for their computers. For example, they offer home control modules that allow you to program the computer to monitor and control devices such as security alarms and lighting in your home.

At the high end of the small computer market Ohio Scientific sells the C3 series of business computers that require big bucks and do big jobs. It is possible to buy a system with high capacity "hard disk" storage systems that can handle millions of bytes of data on one disk.

A person with limited funds and an itch for a computer that speaks BASIC could do worse than a Superboard II. And while the higher priced Ohio Scientific systems will never win an award for style and elegance, they hold their own against similarly priced systems when it comes to functional utility. Prospective buyers with local Ohio Scientific dealers should consider this line before buying a computer with a bigger name.

HEATH/ZENITH COMPUTERS

The Heath Company in Benton Harbor, Michigan is a microcomputer manufacturer that started slow but has consistently improved its product line. Heath is an established manufacturer of amateur radio equipment, emphasizing assemble-it-yourself products. Their kits are, without doubt, some of the best in the world.

A few years ago Heath began selling several computers targeted primarily for the hobby market—people who want to tinker with, modify, and generally play with their system. People who bought the Heath computers usually knew (or wanted to learn) a great deal about the way computers worked and did not need a computer that could be set up in an office and made to do a day's work from the beginning.

The original Heath computer, the H8, is still available but it is not a "complete" computer like the others discussed so far. For example, it does not have a video display or keyboard input facilities. You must buy a video terminal and connect it to the H8 if you want to talk to it in BASIC. The same is true for a more advanced computer designated the H11A which can use programs written for a popular minicomputer, the PDP-11.

Two things have happened at Heath recently that make their computers more interesting to a larger number of people. First, Heath was purchased by Zenith who has an eye toward moving into the small computer field. Second, they decided to build computers that are integrated systems with business and professional software available. The H89 computer costs about $1700 in kit form. It is also available assembled. The layout resembles the Model II, TRS-80. Everything is in one case–monitor, keyboard, disk drive. The display is black and white with 24 lines of 80 characters. Keyboard feel is very good, the disk system works well, and there is 16K of RAM (expandable to 48K). The H89 is a sophisticated computer system with many desirable features. Heath now has a moderate amount of software for the H89 and they are now offering CP/M. This makes the very large amount of CP/M software available for use on the H89. When considering this sytem be sure to include the cost of "options" which are normally included in the cost of other systems. A 5¼-inch disk drive is included in the base price of the H89, but serial and parallel interfaces and the Microsoft disk BASIC for the H89 cost extra.

SINCLAIR ZX80 AND MICROACE COMPUTER

Video Display. This system displays 24 lines of 32 characters, upper case only, black and white. Graphics are also possible. The computer has its own video modulator which transmits on UHF channel 37. Most standard televisions will serve nicely as a monitor.

Keyboard. It is a small, touch-senstive, plastic membrane-type keyboard that is arranged in the same format as a typewriter keyboard, only smaller. Using this keyboard is difficult because you must press it with some force. Similar keyboards have a tone that sounds when you press each keypad. This one doesn't; the only way you know that a keypress has been registered is to look up on the screen and see if the correct letter has appeared. The keyboard is probably the weakest feature of this computer.

Chip Used. Z80.

RAM. This system provides 1K of RAM; sockets are there for an extra 1K, and more memory can be added by buying extra "cartridges" that attach to the back of the computer. This computer makes very good use of its RAM space. The manufacturer claims 2K and it does the job of 4K in other computers because the programs are stored in memory in a sort of memory-saving shorthand.

Languages Used. BASIC is provided in ROM; all other programs are stored on cassette tapes. The standard BASIC used in the computer is not Microsoft-compatible but it is adequate. It is, however, an "integer" BASIC which means it only works with whole numbers. Decimals are not allowed unless you do some fancy programming. An extended BASIC, available as an option, will deal with all sorts of numbers.

ROM Software. BASIC is in ROM.

Storage. The user supplies a cassette tape recorder for data and program storage. The system appears to work reliably.

Software. This is a relatively new computer with little software for it other than the programs at the back of the instruction manual. At least two magazines or newsletters devoted entirely to this computer have already sprung up, however, so you can expect to see more software for it soon.

I/O Ports. The computer connects to a television and a tape recorder. Printer and modem interfaces should be out soon, but are not available at present.

Service. A mail-in repair service is available but the system is so simple that it should be very reliable.

The Sinclair ZX80 is made by an English company known for producing consumer electronics products on the cutting edge of advanced technology. They developed the first pocket-sized television, for example. The most amazing thing about this computer is its price – $200. If that is still too high, a company called MicroAce sells the same computer in kit form for $149. It takes about three hours to put the kit together.

What do you get for your money? Well, it isn't an IBM 370 but it is a real computer that speaks BASIC. The keyboard is hard to use, but what do you expect for that price? The keyboard alone on some computers costs more than $200! The ZX80 is only 6½ inches wide by 8½ inches long. It is small enough to be carried in a briefcase, but it does have a small power supply pack that must be plugged into the wall. You may be ashamed of its puny dimensions when someone plops their Sorcerer or TRS-80 down beside it, but the ZX80 is one of the cheapest ways we know of to get started with small computers.

If you or your child want to learn BASIC, the ZX80 has some features that are particularly useful for the beginner. For example, each new line of a program appears at the bottom of the screen as you type. If there is a syntax error in the line, the computer will not accept it. The error must be corrected first. In addition, all BASIC commands can be entered by pressing a single key. The BASIC instruction LIST, for example, can be entered by pressing the "A" key at the beginning of a line. There are limitations to this computer, but they are surprisingly few when the cost is considered.

SUMMARY

Although this is one of the longest chapters in the book we still haven't even mentioned many computers. The 99/4 computer from Texas Instruments has been omitted, for example. We chose not to cover it because, in spite of advertising and Chrysler-like cash rebate offers, the 99/4 has been a commercial failure thus far. We expect TI to come out with a new and improved small computer that will take the place of their first effort. Other computers such as those from North Star, Vector, Dynabyte, and Cromenco are excellent products. There was simply not enough room to cover them here.

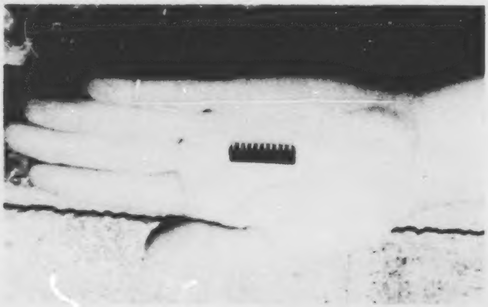
Because of these omissions and because the market is continually changing, we suggest you use this chapter as no more than a starting point. Even the computers we did review will change and improve. Spending your money wisely on a computer calls for a careful study of the current market. Several hours of shopping and comparing may save hundreds of dollars in the short run and many hours of grief in the long run.

Chapter 8

The Stuff That Makes It Happen: Software

For the beginner, computers often appear just short of magical. Even with their covers off, computers give few hints of how they operate. There are no gears turning, no dials revealing telltale signs of activity. The only moving part you may see is a cooling fan (sadly lacking on many small systems today).

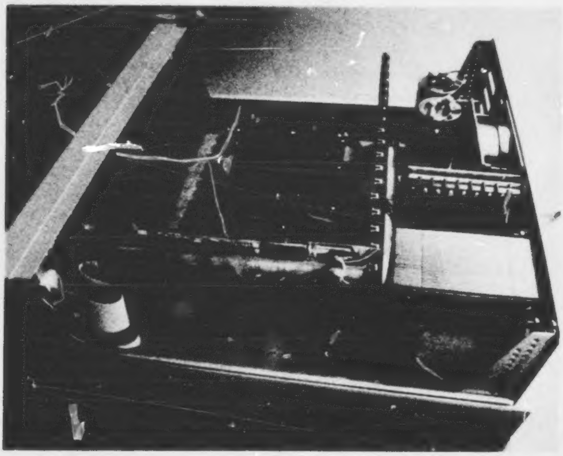
The working components of small computers are integrated circuits (ICs) which have no moving parts. In fact, most of an IC is just protective plastic. Sealed inside all that plastic is a tiny silicon chip which does all the work. The silicon chip is so small it can be placed on the tip of your finger with room left for several thousand angels (at least) to dance around too.



ICs, the heart of a computer

If computer machinery seems mysterious, computer software is equally amazing. If the computer were a kitchen (with the stove the CPU) the software would be a recipe to be followed.

Just as there are many different types of recipes, so too are there many different types of software. Some of the programs you will use were probably written in "machine language," for example. Most software, however, is written in one of the "higher-level" languages.



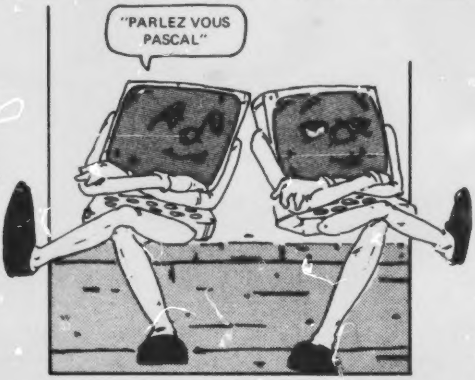
Interior of a small computer

LANGUAGES FOR COMPUTERS

The computer in your home or business probably speaks several languages. No, it won't converse fluently in French or Pharsi but it will probably speak BASIC, maybe PASCAL, and probably some dialect of a cryptic group of languages called "machine language."

The particular CPU chip used in a computer determines which "machine language" it speaks. The Atari computer, for example, has a 6502 CPU chip in it. Not unexpectedly, the Atari speaks 6502 machine language. The TRS-80 from Radio Shack, the Sorcerer from Exidy, and the North Star computer all speak Z80 machine language since they have Z80 CPU chips.

Although much of the software in a computer is written in machine language, most beginners will want to leave that language to the experienced programmer. It is hard to use, very tedious, and time consuming for the programmer. To use it requires some dedicated study of the machine language used



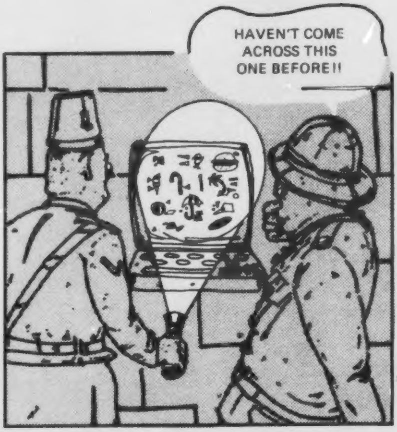
in your system. Machine languages also use funny number systems (hexadecimal, octal, or–heaven forbid–binary) instead of the familiar family favorite, decimal. Here is an excerpt from a machine language program:

```
004000 072      LD A
004001 037
004002 004
004003 117      MOV C,A
```

All the numbers are written in octal, a base-8 number system. The first column of numbers (004000) specifies the memory cell in the computer where the instruction is to be placed. The second column (072) lists the actual instructions. Computers don't understand words or letters, so everything must be converted to numbers before the CPU chip can actually process the information. The 072 in the first line of this excerpt will cause the computer to perform a particular function. In this case it takes the two numbers that immediately follow the instruction (037 and 004 in this program) and puts them is a special storage location inside the CPU chip. The last column lists a sort of shorthand summary of what the computer will do as the instructions are followed. The term LD A, for example, stands for "Load the Accumulator with the contents of the memory location selected by the numbers that follow." MOV C,A means "move whatever is in storage location A to storage location C." The computer only deals with the numbers in the second column, the machine language instructions. (The first column tells the user where to put the instructions in the computer's memory and the third column is helpful when you want to read the listing of a machine language program and figure out what's happening.)

It takes thousands of the machine language instructions to perform even a simple job like keeping track of a list of names that will be printed on mailing labels. Again, we would suggest that you wade into machine language programming only after you've gained some experience with an easier language like BASIC.

In between BASIC and machine language is something called "assembly language." Remember LD A and MOV C,A in the previous excerpt? Using a special program called an Assembler, it is possible to type in phrases like LD A and MOV C,A and have them automatically converted into the proper machine language codes by the computer. Since it is much easier to remember what MOV C,A means than it is to remember numbers like 117, assembly language work is a lot easier than machine language. It is still necessary to know the intimate details of machine language programming, however, before assembly language work can be done. Take heart though, there is another way.


HAVEN'T COME ACROSS THIS ONE BEFORE!!

Higher-level languages allow a beginning user to start working with the computer in a very short period of time. This family of languages uses English-like words and mostly decimal numbers in the programming process. The best known of these languages, BASIC, is easy to learn. A weekend's work with a good BASIC instruction manual is enough to get a person started nicely. BASIC stands for Beginners All-Purpose Symbolic Instruction Code. Here is an example of BASIC:

```
10 PRINT "HELP, WHAT IS YOUR NAME?"
20 INPUT N$
30 PRINT "WELL",N$,"I'M GLAD YOU'VE COME OVER. I WAS LONELY"'
```

As you can see, BASIC is more familiar than machine or assembly language. In BASIC each line of instructions has a line number. The three lines shown here are numbered in increments of 10. They could have been numbered 1, 2, and 3 or 49, 61, and 333. The computer doesn't care. It is best to always leave plenty of room between lines just in case you need to go back and add extra lines to the program. Between line 10 and line 20 in this program at least nine more lines could be added (e.g. 11, 12, 13, and so on). Some BASICs even allow line numbers such as 10.2 and 10.3.

BASIC understands a set of keywords which have a specific meaning for the computer. In the example the keywords "PRINT" and "INPUT" were used. Another keyword in BASIC is "RUN." If you typed the three-line program into your computer and typed RUN, the computer would begin executing the program. That is, it would look for the line with the smallest number (in this case line 10). Then it would follow the instructions given there. Line 10 tells the computer to print the material between the quotation marks on the screen. Thus

```
HELLO, WHAT IS YOUR NAME?
```

would appear on the screen. The keyword in line 20 is INPUT. That tells the computer to stop and wait for the user to type in something on the keyboard. Suppose you type in CHARLIE. The computer takes CHARLIE and assigns it to the label N$. Now N$ equals CHARLIE. In line 30 the computer finds another PRINT instruction. It will print the following on the screen:

```
WELL CHARLIE, I'M GLAD YOU CAME OVER. I WAS LONELY.
```

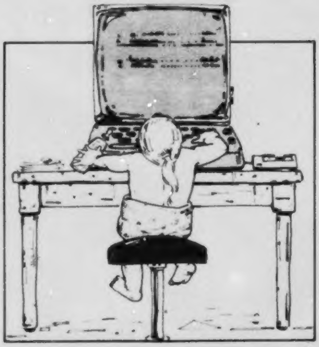
The computer printed everything inside the quotation marks just as it appeared (e.g. "WELL" and "I'M GLAD YOU CAME OVER. I WAS LONELY."). The N$ is not enclosed in quotation marks, however. Instead of printing out N$, the computer looked at its list of labels and found that N$ stands for CHARLIE. Thus it printed CHARLIE instead of N$.

BASIC is, without question, the most popular small-computer language today. More people work with BASIC than with FORTRAN or COBOL. These two older languages are used respectively in scientific work and business applications. There are, however, at least a hundred other high-level languages, each with a group of supporters who believe their language is the best. Some of the other languages are specialized. PILOT, for example, is designed expressly for educational applications. Others are general-purpose languages which were written because someone saw deficiencies in the currently-available languages. One of these general-purpose languages, PASCAL, is currently developing a large following among small computer users. Some say it will replace BASIC in a few years as *the* language. Perhaps. Its sort of like the old argument: which is better, the curve ball or the fast ball? Who knows? It really depends on your application.

We do not want to leave you with the impression that BASIC is a single language and that BASIC on a PET is the same as BASIC on a TRS-80 or an Apple II. BASIC is actually a family of languages. While it is relatively easy to shift from one version to another there are real differences among the BASICs supplied with different small computers. Some of these differences reflect nothing more than the personality traits and preferences of the programmers who designed the BASICs. Other differences reflect the increased power and usefulness of some BASICs. The keyword "PRINT," for example, is understood by every BASIC. The keyword "PRINT USING," however, is found only in larger, more sophisticated BASICs. One version of PRINT USING allows the programmer who wants the computer to print payroll checks to specify the format for the checks (e.g. $175.22 instead of $ 175.22345).

Another impression that is often left after a discussion of the various programming languages is that users *must* learn to program computers in some language whether it be BASIC, PASCAL, or machine. This really isn't true. It is nice to be able to write some of your own programs or to at least know enough to modify and adapt the programs written by others. It really isn't necessary, though. With the boom in small computers that has occurred over the last five years there are thousands of programs just sitting on dealers' shelves or waiting in the computer magazines.

Jerry just bought a program called MIMIC. It's marketed by INSTANT SOFTWARE, a strong force in the field. He picked up MIMIC for $7.95 at Jerry Scott's Sounds Etc, an excellent Radio Shack outlet in Watonga, Oklahoma. MIMIC is a computer-enhanced version of the memory game called SIMON. It gives you a pattern of sounds and lighted panels and expects you to repeat the pattern by pressing the panels in the correct order. Jerry's nine-year-old daughter, Amy, has her own TRS-80 and spends hours playing MIMIC. MIMIC is written in Radio Shack's Level II BASIC, but Amy hasn't yet mastered BASIC. All she must do is put the MIMIC cassette in the tape recorder, turn the machine on, type "CLOAD." and wait for the computer to tell her the program on cassette has been loaded into the computer (CLOAD is a keyword that tells the computer to look for a program on the cassette). When the computer tells her its ready, Amy types RUN and plays the game. Later Jerry hopes to entice her to get involved with BASIC, but for now she has a library of about 30 programs, mostly games, which she and her friends play. Amy's mother, a child development specialist in



a mental health center, uses the same computer to type reports and papers. She doesn't speak a computer language either, but she has learned to use a nice word processing program called Electric Pencil. Joan can load Electric Pencil in from the cassette. She has mastered the 20 or so commands used by the word processing program. An afternoon of study is all that is required. Knowing those 20 commands, however, turns a $700 computer into a word processing system that is as good as many commercial systems with price tags in the $15,000 range. You don't have to master computer programming to use a small computer.

In the final section of this chapter we will sample some of the programs available today for small computers. While our little tour will do no more than hit a few of the high spots, it will help you get an idea of the tremendous range and variety of software already available for small computers.

SOFTWARE FOR SMALL COMPUTERS

There is so much that can be said about the thousands of programs available to small-computer users. For instance, we chose only 60 programs for Chapter Two because we needed a stopping point. We could have chosen 1000. For the beginner, though, it is most important that sources of information about computer software be identified. Where, for example, do you find out whether anyone has written a program that determines when the OSCAR amateur radio satellite will be overhead during a particular time period. You'll find the answer in just a moment. Then we'll describe the sort of software packages available today. Software is divided into five major areas: games, business programs and word processing, educational programs, home applications, and hobby applications.

SOURCES OF SOFTWARE INFORMATION

Many computer owners do no more than browse through the software displayed on the shelves of their local dealer. That's a good place to start, but no one dealer can possibly afford to stock even one copy of every program now being sold.

Fortunately there are several excellent sources of software information. They take some of the sweat and legwork out of your search for the perfect computer program. There are many inexpensive "guides" that, taken together, provide a fast, efficient means of finding the software you want. Here is a description of the three most popular guides:

The SSI Microcomputer Software Guide, Jim Schreier, 1980. Available from SSI, 4327 E. Grove Street, Phoenix, Arizona 85040. The 1980 edition costs $9.95. This 124-page book lists 2000 different programs for small computers. Some of the programs come from magazines or books, and are thus free if you have the issue where they appeared. Others are from commercial software sources and cost from a few dollars to a few hundred dollars. On page 98 under "Satellites" two programs are noted. One called "Orbit, Time, and Longitude of OSCAR" appeared in the November, 1977 issue of 73 magazine. Schreier's categories range from Accounting to Handicapped Assistance to Video Games to Word Processing. This guide is well worth the price.

Periodical Guide for Computerists, E. Berg Publications, 14751 112th Ave. N.E., Kirkland, Wa. 98033. This guide is now published yearly. The 1979 issue includes categorized listings of 3000 magazine articles drawn from 24 different magazines that deal with small computers. The cost of the 1979 issue is $5.90. The 1978, 1977, and 1975-76 issues are $5.00 each.

We refer to the *Periodical Guide* regularly. Each article indexed is listed under at least one of 120 subject categories. Most articles are listed under several. If you want to see what's been written about the Ohio Scientific computers you'll find 24 articles about them in the 1979 issue. They're under "Microprocessors: Ohio Scientific." Several owner reports and product evaluation articles are included. There is also an article on the BASIC used by Ohio Scientific and an article on ways of improving some of the standard software that comes with this computer. In the same issue of the *Periodical Guide*, 74 articles about the PET computer are listed, 58 for the Apple, and over 100 for the TRS-80. Many of these articles about specific computers contain programs that can be typed in on your computer and used immediately.

Berg's guides cover hardware as well as software and rank among the best of the indexing services. They are easy to use, comprehensive, and inexpensive.

TRS-80 Software Source is a publication available from Computermat, P. O. Box 1664, Lake Havasu City, Arizona 86403. Single issues are $6.00, a yearly subscription is $15.00.

This is one of the growing number of publications that provide specialized lists of software for a particular computer. The *TRS-80 Software Source* for Fall-Winter, 1980 lists over 5000 different programs for the TRS-80, most from commercial suppliers. Programs are arranged into several broad categories (e.g. Business, Education, Games, Home, Math, Utility). Programs within each category are listed alphabetically, by source, and by the version of BASIC required for their use. Unfortunately, there is only a three to five word description for each program. The listings give the name of the program (e.g. Accounts Receivable), a terse description (e.g. records/aging/payments), and other pertinent information such as price, how much memory is required to run the program, and the supplier. We would be happier with this publication if it gave a little more information about each program. With 5000 programs to cover, however, that is really an unreasonable request. The *TRS-80 Software Source* will be useful to people who want to find out who has what software. Then you will have to write the supplier for more information.

The number of programs listed in this guide gives some indication of the number of people who are writing programs for small computers. There are seven different accounts payable programs listed which range in price from $25 to $240. There is an office billing system for a chiropractic clinic, 12 general ledger programs ($25 to $899), 18 payroll programs ($19.95 to $1200) and hundreds of games at very reasonable prices.

Other Sources of Information

One of the best ways to keep up with software is to subscribe to one or more of the computer magazines. Several of them regularly publish reviews of commercial software. All of them publish useful programs that are free to subscribers who want to type the programs in on their own computers. *Interface Age* carries many articles on business applications and has regular business-oriented features. *80 Computing* only deals with software and hardware for the TRS-80 and publishes very good reviews of commercial software as well as original programs for Radio Shack's little jewel. *Micro* specializes in articles about 6502 computers (KIM, Apple, PET, Atari, SYM, AIM). *Creative Computing*, *Recreational Computing*, and *Personal Computing* lean toward games and home and educational applications although there are exceptions.

In addition to the slick magazines mentioned already, there are many smaller publications–some of them mimeographed –which serve specialized markets. Most are concerned with a particular computer. The TRS-80 computer can boast of at least 10 such publications and there are user-group publications for the Apple, Sorcerer, Compucolor, North Star, PET, and many others. Many of these "little" magazines specialize in reviews of new software. The reviews can be brutal if a company has released software before all the bugs were corrected. The field of special-purpose magazines tends to be a bit fluid. There are always new ones appearing and old ones that aren't anymore. Your best bet is to ask a local dealer about publications for your system. See also the last chapter in this book for more information.

A Short Survey of Small-Computer Software

Games. A quick glance through the computer magazines will convince you that the availability of computer games is virtually limitless. If you played games 24 hours a day it would take several years to play every game available just once, and by that time the number of games would have doubled or tripled. There are excellent board games including several versions of chess and checkers. Simulations are abundant too. You can be king of an ancient nation, chief executive officer of a major corporation, a stock market speculator, or leader of a group of explorers lost in space. There are also arcade games where you must control a laser ray or cosmic cannon to protect the fleet from alien invaders. There are road races, football games, enough gambling games to rival Las Vegas, and enough war games to get a good start on WW III.

Many of the computer game programs are very well designed. They have excellent graphics (some also have sound); they test the human player's skill and intelligence; and they are generally inexpensive. Most cost between $7.00 and $20.00.

Home Programs. In this category are programs that help you complete state and federal income tax forms, programs that set up and manage exercise and diet regimens, programs for family finance and checkbook balancing, programs to help with home energy management, as well as programs for home protection and a myriad of other applications. Programs are also available to figure loan costs, print mortgage amortization tables, keep track of deductible expenses, and adjust recipes to feed more or fewer people. As time goes on, there will be programs for any common home application.

Hobby Programs. Perhaps because most amateur radio operators (hams) are also interested in electronics, small computers have probably seen more use in this hobby than in any other. Many hams have computers that send and receive Morse code. The ham sees the code received by the computer as standard letters and numbers on a video monitor or printer. Hams can buy programs that help them design efficient antennas and filters, plot the orbit of ham radio satellites, and keep a record of all the hams they've talked to, with the records organized by country, state, and call sign.

Computers are being put to use in other hobbies too. The secretaries of many local and national organizations use a computer to keep track of membership lists and to prepare newsletters. Music enthusiasts can choose from over 50 programs that help compose, synthesize, or play music. Some of these programs require the user to buy additional equipment, but the results can be very good. As usual, the quality of the music produced improves as the price of equipment increases. Music programs and hardware in the $200 range produce excellent results. Photo bugs can buy several computer programs to help them select film for a particular purpose and to control the various phases of developing and processing. And finally there are programs that help amateur (or professional) knitters and weavers design original patterns by computer.

Educational Programs. Programs for educational applications are available for everything from shape discrimination for preschoolers to advanced electronics for adults. You can teach yourself or the kids basic math facts, English grammar and punctuation, metric measurement, fractional math, deductive logic, astronomy, algebra, music composition, typing, poetry writing, spelling, and vocabulary development.

While there are a number of very good CAI programs (Computer Assisted Instruction) we're not that enthusiastic about the current crop of educational programs. Some are best considered good first efforts rather than polished finished products.

There is a great deal of activity in the educational computing field, though. The journal, *Computing Teacher*, helps keep interested educators up to date on new software. In addition, the national organization, Conduit, has moved into the field of small-computer software. Conduit has a catalog of currently available programs, most of them on university-level topics. The organization can also serve as a review and distribution service for programs you or your colleagues develop. The Apple Educational Foundation was recently organized to encourage the development of sound educational software for small computers (not just the Apple) and has plans to evaluate, catalog, and distribute educational software.

Business Software. Some of the most expensive and most professionally prepared software is in this category. Large and medium sized businesses are accustomed to paying thousands, even hundreds of thousands of dollars for computer hardware and software. For the money they pay, businesses expect durable equipment that runs reliably and quality software that is easy to use and bank-examiner accurate.

The traditions of quality are seen in many, but not all, small-computer business programs sold today. Business software is also more often "packaged" than other software. That is, the business is often expected to buy a packaged group of general programs rather than single programs. Several companies, for example, sell packages developed by Adam Osborne's group of programmers. There is a General Ledger package, Accounts

Receivable, Accounts Payable, and Payroll. In the case of Osborne's software these packages can be purchased for around $100 each.

Other companies bundle their business programs together and sell the entire set for a single price. Since the investment may be sizeable and any problems may be costly, business software purchases should be made carefully. The dilithium book, *From the Counter to the Bottom Line*, by Carl Warren and Merl Miller is a good place to start. Back issues of *Interface Age* also contain many articles on buying business software. See also Lawrence Ferdelman's article "Shopping for a Payroll System, What to Look For" (*Creative Computing*, March, 1979) and "Computing Power for Small Businesses" by Charles Sippl and Fred Dahl (*Kilobaud Microcomputing*, October, 1979).

Not all business software comes in big expensive packages. There are several programs that maintain mailing lists for under $50. The most popular single business program, however, is probably a word processor. There are currently over 50 major word processing programs on the market with prices ranging from $20 to $500.

What does a word processor do? It turns your computer into an electronic typewriter. Letters, papers, reports, and books can be created, edited, and modified electronically. Using the keys on your computer's keyboard you can display material on the screen and delete, replace, or rearrange individual characters, lines, and paragraphs. As updated or edited versions of a document are created, they can be saved on a cassette or disk and used later (or printed out on your printer).

This book was written and edited on a small computer using the Electric Pencil word processing program. Versions of the Electric Pencil cost from $99 to $300. We've also used the Word Processor Pac ($199) for the Exidy Sorcerer and SCRIPSIT ($99) for the TRS-80. The Electric Pencil is the easiest to use but has the fewest features. Exidy's word processor is good but suffers from a very poorly written instruction manual and a few design flaws that can drive you crazy. SCRIPSIT is a newcomer to the word processing race and is the slickest of the three. It comes with a set of cassettes that provide instructions for initial users. It has a very well prepared manual, and SCRIPSIT has features not found in the other two word processors. There are more sophisticated word processing programs with higher price tags but we've found we can get along very nicely, thank you, with any of the three "cheap" programs mentioned here.

Some final comments should be made about business software. First, many programs use large amounts of memory. Business systems often have at least 32K or 48K and sometimes 64K. Second, all but the simplest business software is written for computers with disk systems. That means you can expect to pay from $500 to $2000 in addition to the base price of the computer for the additional disk capacity needed to run many business programs. Although we still use cassettes for word processing work, a disk is usually the minimum requirement for business use. Some programs expect a minimum of two disk drives.

You may notice some cryptic references in business software advertisements to CP/M, CBASIC or some other unfamiliar term. While ordinary versions of BASIC are fine for many uses, the extra demands of business software sometime require a souped-up version such as CBASIC. If the software you're considering calls for one of the fancy BASICs be sure to include the price of it in your figures. Perhaps the most commonly mentioned prerequisite for business software is CP/M. CP/M was created by Digital Research as a replacement for the less powerful operating system software that comes with many computers. (An operating system or OS is a piece of software that does much of the housekeeping and data management inside the computer.) CP/M costs around $150 or more depending on the version. There are versions for most of the major small computers, but they require at least one disk drive to operate. With CP/M the user can run many different programs that could not be used with the standard operating system that came with the computer.

One final comment, regardless of what you decide to do with your computer, you will need good software. Try to evaluate everything you consider buying and then buy the best. You'll save yourself a lot of frustration.

Chapter 9

Some Nice Things You Should Have

The ad for that new computer may prominently display, in large letters, a price that sounds good. It may be $595, $995, or even $1295 (it seems there's always a 95 or 99 on the end, rarely 05 or 01). Whatever the price quoted, that may not tell the whole story. Some manufacturers quote prices for complete systems—everything you need to get started. Prices quoted by other suppliers, however, many not include some of the necessary equipment or accessories.

The first computer Jerry bought cost $995. It was a kit containing at least 20,000 pieces. (At least it seemed like that many before it was assembled.) As it turned out, the $995 did not include everything needed to use the computer. He spent $65 on a tape recorder, $150 on a monitor, $600 for 16K of memory, and $75 for BASIC. The $995 computer actually cost $1885 by the time he had everything needed to get started.

This chapter will discuss seven types of "essential accessories": video displays, cassette recorders, memory, input/output devices, mistake fixes, and printers. If you're fortunate, everything you need will come with the computer. That's unlikely, though. There will probably be something which costs extra.

Video Displays

Computers like PET have a video display built-in. Others such as Exidy's Sorcerer, the Apple, and the Atari must be connected to some form of monitor.

Standard Televisions. Perhaps the cheapest way to get a video display is to use a regular black and white or color television. It is possible to connect most computers to a TV in one of two ways, neither of which prevents normal use of the set as a receiver. The least complicated way involves buying a "video modulator" similar to those built into TV games. The modulator is really a tiny, low-power transmitter that sends the signal from the computer to the television. Most modulators use either channel 3 or 4. They cost $10-$30 depending on quality. Radio Shack sells a modulator kit, and several others are advertised in the computer magazines. Modulators are susceptible to interference, and the characters on the screen may be rather fuzzy, particularly if your computer is one that puts 80 characters on each line. There are exceptions to this general criticism, however. The Atari and Apple computers both connect to a color television via a special modulator and both provide very good quality.

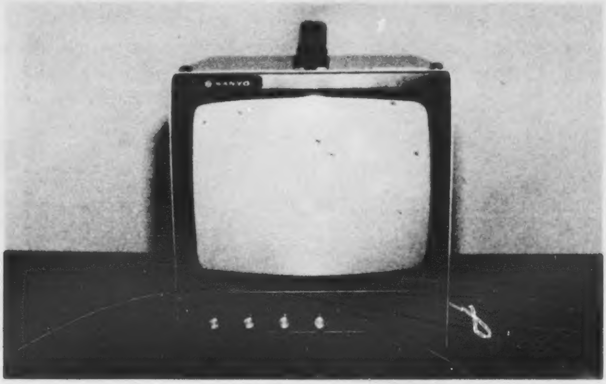
HITACHI
WE ARE EXPERIENCING A
TECHNICAL DIFFICULTY
PLEASE STAND BY
CHARLOTTE

A converted television used as a monitor

Some televisions can be converted to video monitors without a modulator, but the change requires soldering a few extra parts on the printed circuit boards. Some televisions (those with a "hot" chassis with 120 volts) are dangerous if converted. Beginners, therefore, should leave this job to an experienced technician. Again, the computer magazines have carried several articles on converting TVs to monitors. Sharpness and clarity of the display will usually be better on a converted set than with a modulator, and a standard monitor will provide even better quality.

Video Monitors. If you can afford one, the best approach to video display for your computer is a video monitor. Monitors are specially designed for the work they do, and the results are almost always superior to that offered by a television. Industrial grade monitors such as those used in airports to display arriving and departing flight schedules can cost as much as $600. Fortunately, there is no need to invest several hundred dollars in a monitor to get a good quality display. One popular monitor for small computers is the Ledex Video 100 which sells for around $130. The least expensive color monitor costs about $400.

At any given time there will usually be some used monitors on the market. While it is easy to get stung with used equipment, a preowned monitor which costs between $50 and $90 can provide years of high quality service.



A standard video monitor

Modified Video Displays. Up to this point we've assumed your computer has the internal circuits for video display, but lacks the monitor. This is generally the case. But what if you don't like the video display system that comes with your computer? Can it be modified? Often the answer is yes. The Radio Shack computer, for example, will only display capital letters. Several companies, including Radio Shack, can modify the standard TRS-80 display so that both upper and lower case letters appear on the screen. The cost ranges from $30 to over $100 depending on the extra features added to the system.

The Apple II is another computer with some limitations in its standard display circuits. It displays 24 lines of 40 characters (upper case only), a format that is not suitable for word processing. For $290 one company offers an expanded display circuit board that plugs into the Apple. Your money buys 24 lines of 80 upper/lower case characters.

Cassette Recorders

With the exception of disk-based business systems, almost all small computers use some type of cassette-based storage in their least expensive model. You will hear people brag that their computer can save and load programs stored on cassettes using bargain-basement tape recorders. Perhaps they can, but ours can't. We have around 15 tape recorders now. Some could be classed as expensive (over $50), some are bargain-basement specials, and some we've bought at a flea market. All these recorders will work with some of the computers some of the time. Less than half, however, will work reliably most of the time.

A cassette-based computer system

There are few things more frustrating to a computer user than a five minute program on tape that takes 30 minutes to load into the computer because it took six tries. It will pay first-time users to select a dependable recorder. While we're sure there are many good recorders, our best experiences have been with the Sanyo M2533A (costs around $60), the Panasonic RQ-413A (expensive), the Atari Program recorder, several higher priced Sony models, and the Sears 61K2168 which sells for around $59. In our own computer lab we're trying to standardize on the Sears model mentioned above. It has several very nice features including a small meter that indicates the signal level when it is recording. The little meter will flutter slightly as the data is recorded, an indication that things are proceeding correctly.

Most computers record data on cassette by converting the data in memory to a pattern of tones. Since only two tones are used (often 1200 Hz and 2400 Hz) the recorder need not be a high fidelity unit. It only has to reproduce those two tones correctly. What is more important is the stability of the tape speed. If the motor speed varies, tape speed varies too, and computers are very intolerant of that. Some manufacturers use the same tape transport and motor assembly in both their cheap and their expensive models. The extra cost of the higher priced models goes toward the amplifier and speaker so that music is reproduced with greater fidelity. When buying a recorder for the computer, you want the extra money to go into the tape transport and motor, not the amplifier and speaker.

When shopping for a recorder look for the following features:

1. Fast forward and fast reverse controls that lock down when pressed. They're more convenient.
2. An accurate counter, conveniently located. If you have more than one program on each tape, the counter can help locate each one.
3. A tone control. Adjusting the tone control makes some computers work better.
4. AC power. Don't use batteries since the motor speed may change as the batteries die.
5. A meter (or a light that flickers) which indicates recording-volume level.
6. An AUX input jack in addition to the normal MIC input. The MIC or microphone input on a recorder is used when

> the signal to be recorded is relatively weak. A strong signal can overdrive this input and produce distortion. The AUX or auxiliary input is used for strong recording signals. Some computers require use of the MIC input, some use AUX.

We should also mention that the reliability of cassette data storage will depend on the type of tape used as well as on the recorder. There is no need to buy the most expensive tape, but expect grief if you opt for 33-cent specials from the discount store. Good quality tapes from reputable companies such as Memorex, Ampex, Scotch, or Sony should do nicely. Use very short tapes, C-10's if they're available, and C-20's or C-30's if they're not. Longer tapes just put more drag and strain on the recorder's motor. If you have 16K of memory in your computer a program that takes up the entire 16K can probably be put on one side of a C-10 cassette. Long tapes are also inconvenient to use since they take a long time to rewind when you want to record a program on the other side. Generally you will want to buy the shortest tapes available. Several companies, including Microsette Inc., advertise "computer tapes" in the magazines. In most cases these are simply standard quality cassettes with around 50 feet of tape in them. We have more than a hundred of Microsette's tapes in use now and find them excellent, and the cost is less than $1.00 each.

Memory

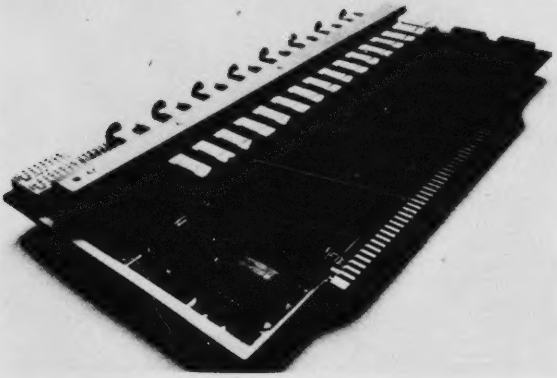
Regardless of the amount of memory that comes with the computer, it won't be long before you'll need more. Whatever can be done with the memory capacity you have, there will always be more that could be done if only there were more memory.

Buying memory can be a bit confusing for the novice. In one recent magazine the price of 16K of memory ranged from a low of $39 to a high of $399. Why the difference? Thare are several reasons. First, the $39 price was for a set of eight memory chips that plug into sockets on computers like the Apple, the Sorcerer, and the TRS-80. These computers all allow for some memory expansion in the basic computer. The sockets are already there. The $399 was for a "memory board" which contains much more than the memory chips themselves. When adding memory to some computers it is necessary to add several control circuits in addition to the chips. Computers from Heath and from Polymorphic, for example, use memory boards that are inserted into slots in the computer. These boards naturally cost more.

THANKS FOR
THE
MEMORY

There are also other reasons for the differences in memory prices. The price of eight memory chips for an Apple II, a Sorcerer, or a TRS-80 ranges from $19 to $100. Do you get the same quality for $57 that you get for $200? Some sellers swear you do, and claim that the difference in price is due solely to the greediness of those who charge the most. In some cases that may well be true. It is possible, however, to get "seconds" in memory chips, and it does appear that some of the companies who sell memory at cut-rate prices do so by selling memory chips that are substandard. Memories differ in the speed at which they can operate. "Slow" memory chips in a "fast" computer can cause all sorts of trouble. Therefore, exercise caution when buying memory at a price that seems unbelievable. We once bit on an ad that offered 2102 memory chips for about one fourth the current price. What we got were indeed 2102's, but they were chips that used large amounts of power, and our computer could only handle chips that were classified as "low power."

There is also another reason to be careful. The original manufacturer of a computer will usually charge the most for extra memory. Radio Shack, for example, prices 16K of memory for the TRS-80 at around $100. We paid $67 for each of two sets of 16K for our TRS-80 a few months ago and paid $100 for another 16K recently. The Radio Shack price includes installation, an important consideration. Adding the memory ourselves required removing the case on the computer. That introduced the possibility of damaging the computer, and it voided our Radio Shack warranty, something many people would not want to do. Exidy Corporation, manufacturer of the Sorcerer, has even threatened to refuse to repair a Sorcerer that comes in with memory not purchased from them. With both the TRS-80 and our Sorcerer we've gone ahead and added extra memory from "nonapproved" sources because of the price spread between the manufacturer and other suppliers. It would be wise, however, to consider the potential consequences if the cheap memory turns out to be flaky or you need repairs on the computer.



A 16K memory board

I/O

Suppose you've finally scraped enough together to get that cute little $595 printer that's been giving you the eye every time you walk past the window of the local computer store. The ad for it says it will work with your computer, so you assume the $595 is the price of giving the power of print to your system. That may or may not be true.

If the printer has a standard "serial" or "parallel" interface you must first check to see whether your computer also has that type of I/O or input/output capability. Most computers can be connected to serial or parallel printers, but the capability is not necessarily a part of the basic computer system. It can cost extra.

Our old SOL computer from the now defunct Processor Technology Corporation has two 25-pin connectors on the back. One of these is a serial I/O port which can be used to connect a serial printer to the computer. Since most printers also use the standard 25-pin connector, it is very likely that the SOL can be connected to a particular printer with no more effort than plugging the printer in and setting a few switches inside the SOL. Even if the printer uses a parallel interface, the work required to interface it will probably be minimal since the SOL also has a parallel I/O connector. The Exidy Sorcerer is an example of a more modern computer that has both serial and parallel I/O circuits on the computer board.

The TRS-80 and the Apple II are examples of very popular computers that do not have I/O ports that can be used for connecting equipment such as printers and modems (telephone interfaces). The expansion interface ($299 extra) for the TRS-80 does have a parallel interface, and a serial port can be added to the expansion interface for $99.

THEY SENT ME THE WRONG PRINTER
PRINTER

Serial or parallel interfaces can also be added to the Apple computer by adding additional boards to the system. They plug in conveniently but can be costly.

Fortunately for computer owners, there are some very crafty entrepeneurs in the computer field who find ways to cut the cost of I/O for computers that don't have the capacity you need. For the TRS-80, a company called Small Systems Software sells a serial interface for $49.95. The interface allows the use of a printer with the TRS-80 even if you don't have an expansion chassis. That's a saving of around $350! It should be pointed out, however, that the expansion chassis includes a disk controller and space for an extra 32K of memory. If neither of those features is required it makes no sense to pay for them just to have a place to plug in the printer.

Another company, Electronic Systems, also sells inexpensive I/O circuits. Their serial board for the Apple is $62, assembled. The Electronic Systems board has the additional feature of being able to input data to the computer as well as output data to a printer. This dual feature means a modem could be attached to the compuer via the serial interface, and the user could talk to other computers over the phone lines. Another supplier, SSM Corporation, sells a board for the Apple that has both a parallel and a serial interface. Its costs $175 assembled, which is much less than the cost of the same features from Apple.

Since I/O capacity can be obtained in a number of ways, it will pay to check out your options before buying.

Mistake Fixes

You would think that after a company lays out thousands, even hundreds of thousands, of dollars to design a computer most of the bugs would be taken care of before the thing hits the market. Sadly, that isn't true. A good example of a big bug in a very popular system is the cassette circuitry in the pre-1980 Radio Shack computers. The early Radio Shack computers were notoriously unreliable. The volume control setting was critical. And even with the volume control correct there were times when the thing still didn't work. The result was a lot of very frustrated TRS-80 owners. Once the fault was recognized several companies offered software and hardware to correct the problem. One of the best "mistake fixes" is the Data Dubber for The Peripheral People. This small black box contains some additional electronics that clean up the signals used in the TRS-80 cassette circuits. Hundreds of TRS-80 owners

QUEEN'S BISHOP TO KNIGHT'S PAWN . . . . . . HUH ???

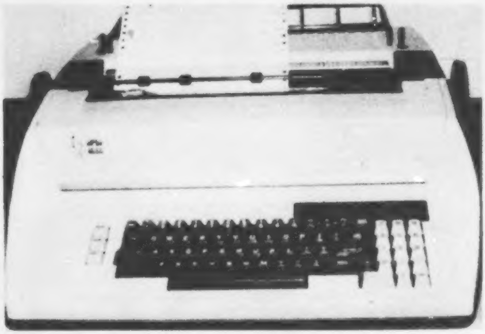
bought it to correct the problems they experienced with the TRS-80. It works excellently. The only question to be asked is why Radio Shack didn't get their system right in the first place (Radio Shack now has a mistake fix for their cassette system that is free to owners.)

Looking at the "mistake fixes" ads in the magazines is one good way to find out the weak points in the computer you're thinking of buying. If the computer has been on the market for a year or more, any fixable flaws are likely to be the target of engineering efforts from several small companies.

Printers

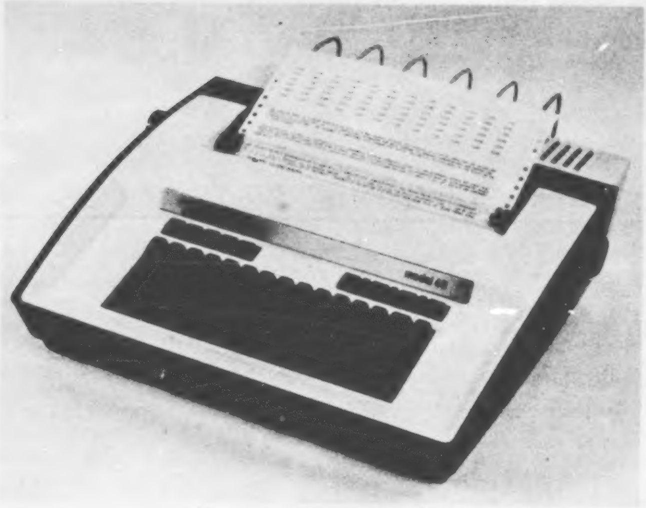
It could be argued that a printer is not an essential accessory for a computer. That's true. Much can be done without a printer. It is also true, though, that for many applications a printer is absolutely essential. It is not possible to do word processing, for example, without a printer. Many small business uses also require a printer. For those reasons this section on printers is included in this chapter.

Just a few years ago choosing a printer was a relatively easy job. There were noisy, clanky Teletype 33's that dutifully printed out their upper-case-only messages for a price of around $1000. Then there was an assortment of well-worn equipment from a variety of sources that cost $400 to $1200, depending on condition. Many of the used printers were originally manufactured for applications very different from small computers and thus required quite a bit of work to get them going. Finally, there were fairly expensive printers designed for use with the big computers and in heavy duty business applications. Companies such as DEC, Centronics, and Okidata were glad to sell their printers to small computer owners. These printers usually worked well, too. The fact that they were built for heavy use applications was reflected in their durability and reliability. It was also reflected in their cost – $1500 to $4000.

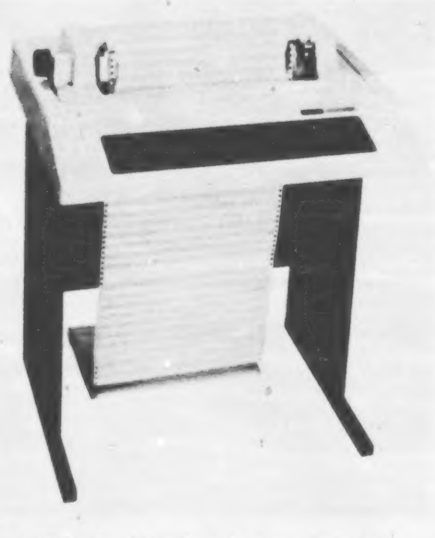


Diablo Printer

Early small computer owners were often shocked to find that a new printer for their system would cost more than the com-



Teletype Printer Model 43



DECwriter II keyboard printer terminal

puter. Many tried to make do with used printers. Some were successful, many weren't.

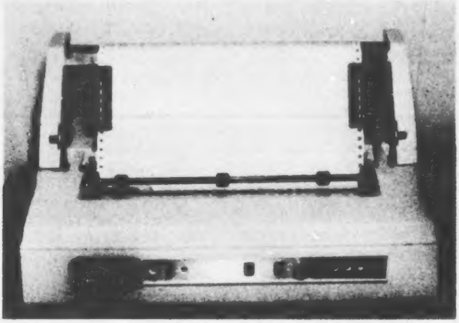
Today the market for small-computer printers bears little resemblance to the market of two years ago. New technology, new companies, and new models have changed everything. It is now possible to buy a reliable printer for as little as $200. Printers in this price range generally print on a narrow strip of paper similar to that used in adding machines. Often the number of characters on each line is limited; 32 columns is common. Such printers can be used to print listings of program or to perform some small business applications such as inventory control, but they are still of limited usefulness.

In the price range of $495 to $885, is a group of printers which use regular width paper and print as many as 80 characters on each line. Matchless Systems, for example, sells the MS-204 for $749. It will print 80 characters on each line at a speed of 63 lines a minute (that's a thousand words a minute!). The MS-204, like most printers in this group, uses the "dot matrix" printing system. That is, each character is created by a pattern of dots. The size and number of the dots varies from printer to printer as does the quality of the characters produced. Output from some dot matrix printers has a crude, but readable appearance. Quality is generally good, however. One dot matrix printer from Sanders Technology, uses a sophisticated printing system that produces print quality equal to that of office typewriters. The Sanders printer, as you might expect, costs almost $4000.

In the $495 to $885 category almost all the printers use a dot matrix format, but they differ considerably in the type of technology used to create the characters. Some use aluminized paper and actually vaporize or burn off the thin aluminum layer to create characters on the paper. Others rely on thermal printing which involves applying heat to special paper that turns dark. Still others use an impact process. Impact printers usually create characters by hitting a ribbon with small wires. The wires force the ribbon against the paper and create a pattern on the paper.

The quality of print produced by printers in this category is remarkably good. It's usually not good enough for business letters or reports, but good. When shopping for a printer in this medium price range, remember to consider the cost of paper.

Some printers use regular paper and can be adjusted to use paper of varying widths. Some require "form feed" paper that has holes along the side. Others can print only on special paper that may be expensive.



Printer showing form-feed paper

The price range of $900 to $2000 contains a variety of printers. Some, like the DECWriter series and the Teletype 43, use an impact dot matrix system similar to that used in less expensive printers. The higher price reflects the greater durability of the equipment. The quality of the print produced is, on the average, also somewhat higher.

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THIS IS DOT-MATRIX PRINTING.  IT IS FINE FOR
YOUR IN-HOUSE COMMUNICATIONS, AND YOU CAN GET
BY WITH IT FOR THE NUMBERS ON YOUR BILLS AND
INVOICES.
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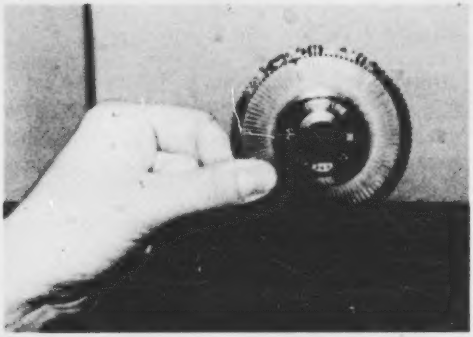
Several printers priced just under $2000 use solid character impact technology similar to that of the well known IBM Selectric typewriter. The characters printed are solid, not made up of dots. The print quality is very high, and regular paper can be used. In the under $2000 range, buyers are generally limited to rebuilt printers such as those from Computer Textile in Los Angeles. Computer Textile sells a Diablo Hytype I for $1695 and a Qume printer for $1895. These are rebuilt units, but reports indicate they hold up well. All use the "daisy wheel" print mechanism, which means different styles of type can be selected by changing the print wheel in the printer. Again, print quality is very high.

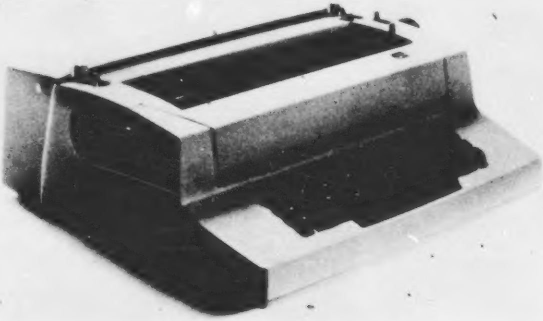
This different type face results from the changing of the print wheel or "daisy" used on the daisy head. **Bold-faced type** is achieved through an automatic double- or triple-striking process that shifts the print head a few millimeters to the right for repeated strokes. Underscoring is also available: the printing head will sweep back to accomplish this on any word or phrase or passage desired.

The daisy wheel printers from Diablo and Qume and the printers from NEC which use a print "thimble" instead of a wheel, in fact, set the standard of quality today. As new units they cost between $1950 and $4000 depending on options. They're moderately fast, reliable, and capable of producing correspondence-quality output. You'll see them in banks, hospitals, word processing systems, car rental agencies, and in pharmacies. Over the past five years printers in the "daisy wheel" group have replaced older printers which were based on the Selectric mechanism from IBM. There are still a number of the Selectric-based printers around, and some have been modified so that they can be connected to the popular small computers. Prices range from $1000 to $1400. The Selectrics also produce very high quality print, but they have many moving parts and are more prone to breakdown than the daisy wheel printers.



A "daisy wheel"

Individuals and businesses that own an IBM Selectric might consider a shortcut to printer ownership: Escon Products in Pleasant Hill, California sells a kit that converts your Selectric into a computer-compatible printer. Escon has kits that will work with most of the popular small computers. Prices range from $496 to $675 plus the cost of installation. The Escon kit is one of the cheapest ways to get correspondence quality print (assuming you already own a Selectric).



A Selectric Printer

The Escon kit requires quite a bit of work to install the system of levers and solenoids inside the Selectric, but the resulting print quality is excellent. Several companies also sell kits that fit over the typewriter's keys. Applied Computer Systems, for example, in Pataskala, Ohio sells a product they call Robottype. It fits over the keyboard of your typewriter and presses the keys as it receives data from the computer. Robottype costs quite a bit more than the Escon kit, but has the advantage of portability. It is easily transferred from one typewriter to another. While Robottype is designed for use on the Selectric II, other companies manufacture similar products which can be used on other brands of electric typewriters.

The conversion systems mentioned thus far are designed for use on traditional mechanical typewriters such as the Selectric. You may be aware of the move toward "electronic" typewriters. Several companies are already offering office typewriters which use small computers to control their operation. IBM's Model 50 and Model 60 are "new generation" electronic typewriters which can be connected to computers for as little as $100 plus the cost of the typewriter (about $1400).

Chapter 10

How To Make Your Computer Sit Up and Sing

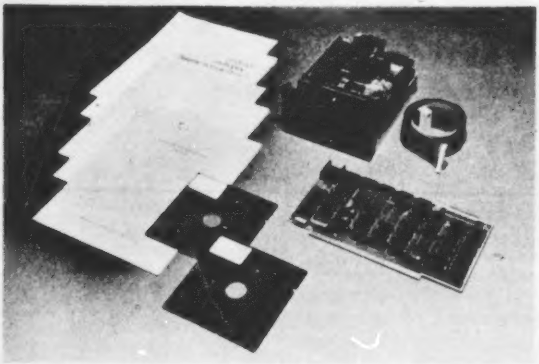
This chapter will survey the vast array of goodies available for use with small computers. Some enable the computer to perform useful and/or entertaining tasks. Some improve the performance of the computer.

Disks

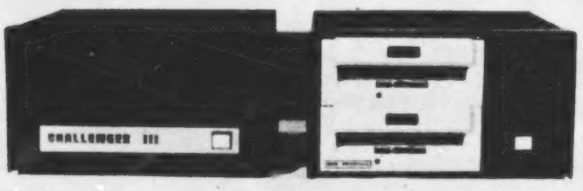
Disks are probably the second most popular accessory for small computers, printers being the most popular. Disks do the same job as cassettes, but they do it faster and more reliably.

There are several types of disk systems for small computers, each with advantages and disadvantages. The most expensive are the "hard disks" such as those offered by North Star and Ohio Scientific. Hard disks use a solid, spinning recording surface to store data. North Star's HDS-18 disk system stores 18 million bytes of data and costs $5000. Few users will need that much storage capacity nor will many smile when they write out a check for $5000. Hard disk systems for small computers, however, are capable of doing large computing jobs that were once the domain of expensive minicomputers.

For those of us with more mundane needs and smaller budgets there are many types of "floppy disk" systems for $500 to $1200. Floppy disks look a lot like a 45 rpm record encased in a protective covering. The term "floppy" refers to the disks' flexibility. Floppy disks come in two sizes, 5¼ inch and 8 inch. Systems using the smaller size disk cost several hundred dollars less, but the 8-inch disk can store as much as three times the data on each disk. Disks are also available in single or double density and in formats that use one or both sides of a disk. Double density systems pack the data more tightly on each disk and increase capacity, and systems that use both sides of the disk naturally have a larger capacity. Disk systems divide the data stored into "tracks" on the disk. Systems also vary in the number of tracks on a disk. A 37-track, 5¼-inch, single density disk system will store several thousand less data bytes than a 40-track, 5¼-inch, single density disk.

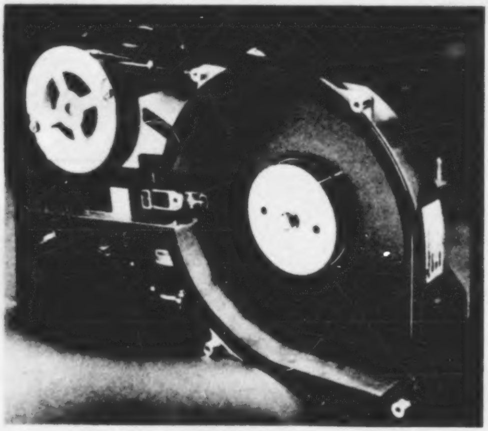


The popular North Star System



Ohio Scientific Dual Disk System

With all the options available, buying a disk system for a computer can be harder than buying a cone at Baskin-Robbins. There are four major factors to consider: compatibility, capacity, reliability, and software availability. Most of the major disk manufacturers produce reliable products. Be sure, however, that the disk you're considering is compatible with your computer. A disk system is made up of the controller circuits, the disk drive itself, and the software for the system. It is possible to buy a single density, single-sided disk drive for a TRS-80 for as little as $250. But you still need the control circuits for the disk drive. They're in the expansion interface in the TRS-80. That's another $299. Then there's the disk operating system – the software that makes it all work. A DOS (disk operating system) for the TRS-80, bought separately, can cost as much as $99. (Note: Some low priced disk drives don't include the power supply or the case so don't assume they come with it unless the ad says they do.)



A hard disk drive with its printed circuit board removed

Buying a disk doesn't necessarily mean buying all those parts separately, however. The North Star disk system, which can be used with several different computers, costs around $700 and incudes a controller board, the disk drive, a very good DOS, and a special BASIC that was created especially for this disk system. Radio Shack's $499 disk system includes everything the North Star has except the controller board. A relatively new company, Vista Computer Company, currently offers a line of high quality disks for several computers including the TRS-80 and the Exidy Sorcerer. Vista's Sorcerer model connects directly to the computer, thus eliminating the need for an expansion chassis. An additional cost factor when adding a disk to some computers is the need for additional memory. Some systems must have their DOS in the computer's memory while the computer is used. If a DOS takes up 16K in a computer that has only 16K of memory that doesn't leave room for anything else.

Now what about capacity? Since we use a computer primarily for computer-assisted instruction and for word processing, a minimum capacity disk system would serve us very nicely. We don't have massive amounts of data to process. A run-of-the-mill single density, single-sided disk system will give us around 80 or 90K of storage on each disk. That's just fine for us, but other applications may call for more capacity per disk or the addition of extra disk drives to increase capacity. Most disk systems permit the addition of three or four disk drives without adding extra controller boards or software. About the only advice we can give is to suggest that you determine the capacity you will need, allow for future expansion (add 25% perhaps), and then look for something with at least that capacity. In some instances you may find that disk systems offered by smaller companies actually have more capacity for less money.

A small disk drive with connecting cables and "diskettes"

A consideration more important than capacity is the software that comes with a disk. North Star, for example, has a disk BASIC with its system that has been used by many software companies. Having a North Star disk means you can then use all that software written in NS BASIC. The Vista disks, on the other hand, provide a DOS program called CP/M with their system along with BASIC-E. CP/M is the foundation for a great deal of high quality software as is BASIC-E. Using a Vista disk gives you access to that software. Again, the software access may be more important than the capacity of the disk. We should mention, however, that both the North Star and the Vista disks are double density systems. Vista can store 200K on each disk.

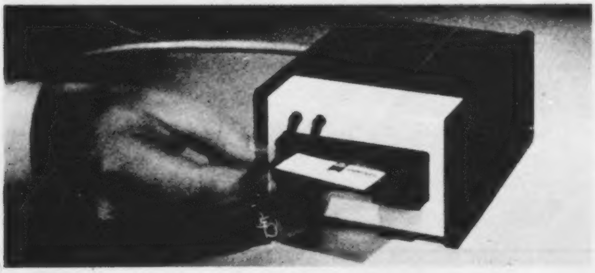
This brief review of disks reflects the current status of the marketplace. There are rumors of a price breakthrough in disk drives, though. In the near future we may see disk drives, possibly from Japan, that sell for half the price of current models. Shop around before you buy.

Disk Alternatives

We have no doubt that most computer users will want to get rid of their cassette systems once they get some experience. But do you need to move from cassette to disk? Not necessarily. There are several storage systems that fall in between the cassette system and a full-blown disk.

Poor Man's Floppy. Sold by JPC Products in Albuquerque, the Poor Man' Floppy for the TRS-80 costs $99 assembled. It uses a standard cassette recorder for storage but provides storage at five times the speed of the standard TRS-80 system. It is not as convenient as a disk to use and has no software advantages, but it is cheap. If you only need speed it may be the answer.

Stringy Floppy. Exatron Products of Santa Clara, California sells an excellent substitute for a disk system. The cost of a Stringy Floppy for your computer will probably run around $300 for everything. This system uses small endless loop tape packs called "wafers" for storage. The wafers come in different lengths and can store as much as 80K on one wafer (the TRS-80 model has a 40K capacity). The Stringy Floppy operates at about 14 times the speed of the standard TRS-80 cassette system, and the unit for other computers is twice as fast. In addition, Exatron has an active user's group which has helped develop quite a range of software for computers using the Stringy Floppy. It is an attractive alternative to more expensive disks.



The Stringy Floppy

BETA-80. The BETA-80 is a tape storage system for the TRS-80 computer from Mecca, an established company in the field. Mecca also offers models of the BETA for several other computers. The BETA units use "digital" rather than audio recording methods. Digital tape systems are common in industrial applications because of their speed and reliability. The BETA-80 is easy to use, can store 500K on each cassette, is seven times as fast as the regular TRS-80 cassette, and is very reliable. The BETA-80, in spite of its speed, is still slow compared to disks. But when you're talking about six seconds versus two seconds to load a very large program, the slowness doesn't seem that important. The only drawbacks to the BETA-80 are its price ($499) and the lack of software compatible with the BETA-80. If Mecca could come up with a version of CP/M for the BETA-80, it would be a winner.

Graphics Displays

For a small investment it is possible to add sophisticated graphics features to computers with limited "stock" graphics. Percom Data Company of Dallas, for example, sells the "Electric Crayon" which can be added to the TRS-80. It's fairly expensive ($250) but it turns the computer into a color graphics machine capable of creating beautiful color pictures, charts, and diagrams. In essence, the Electric Crayon gives the less expensive TRS-80 color graphics features similar to those on the more expensive Apple computer.

An oddball but interesting way to increase the graphics features on the TRS-80 is the ElectraSketch from Macrotronics in Turlock, California. It is a piece of software which is loaded into a TRS-80 with an expansion interface and a disk. The price is a low $14.95. The ElectraSketch is a fascinating program that makes it easy to create animated pictures, diagrams, and charts on the TRS-80. At a demonstration of ElectraSketch, we saw a detailed diagram of a four-stroke engine complete with a moving piston, intake and exhaust valves that worked, and gasoline vapor that flowed into the cylinder. While not in color it was one of the best visual displays we have seen. Visuals created by the ElectraSketch can be saved on tape or disk and used later.

Home Control Interfaces

Would you like to control the humidity and temperature in your home by computer? Do you have some solar collectors that require continuous monitoring? Would a burglar system that sounds an alarm and calls the police be helpful? Do you want your computer to monitor the moisture in your petunia bed and add water as required? All these things are possible with one of the home control modules now offered for small computers. Most of the units take advantage of the home control equipment manufactured by BSR and sold by Sears, Radio Shack, and other. Ohio Scientific has been a leader in producing home control modules for their small computers. A home security system costs $249 and their home control interface is $175. The control interface can be taught to do any

of the jobs noted above using the appropriate sensors and control modules. Similar units for other computers are also available. Mountain Hardware, for instance, markets the Introl/X-10 for the Apple. For around $300 you get a functioning system which includes the software needed to control a variety of devices in your home.

Light Pens and Joysticks

Expensive video terminals often include a "light pen" as well as a keyboard. A terminal with a light pen can put a multiple choice question on the screen and allow the student to choose an answer by placing the light pen on the screen beside the answer selected. The computer "reads" the location of the light pen and decides whether the student has selected the correct answer or not. Game playing is another common application of light pens. You can tell the computer where you want your next "X" in Tic Tac Toe, for example, by placing the light pen on the correct square.

Light pens for popular computers are readily available and inexpensive. For the TRS-80 and the Apple they cost from $20 to $40. Most come with a few game programs that use the light pen for input and instructions for adding pen input to programs you have purchased or written yourself.

Joysticks, those little boxes with a lever on top that come with most TV games, are also available. They cost about the same as light pens but are used almost exclusively in games.

Modems

One of our friends at Texas Tech University owns a TRS-80. He also does quite a bit of work on the big IBM 370 at Texas Tech. In addition to using the TRS-80 as a stand-alone computer, he uses this little computer to talk to the university computer by phone. To accomplish this he added a serial port to the Radio Shack computer and bought a modem which is connected to the serial port on the TRS-80. A modem converts the electrical pulses from the computer into tones which are transmitted over ordinary phone lines.

A few years ago we bought a used modem for $35 which has served us well. Today that same modem costs $100 used and twice that much new. When small-computer users became aware of the possibilities for "talking" to other computers over phone lines the market for used modems went through the roof. Expect to pay at least $100 for a modem unless you build it yourself. A standard, brand name modem can cost over $200, and a modem with special features can put a big dent in the old back pocket. Electronics Warehouse offers a high quality modem designed especailly for the Apple computer for $285. That price includes some software on tape that eliminates the need for a serial I/O port.

In many areas computer owners with modems can dial up a bulletin board service run by their computer club and read the latest newsletter off their screens. In addition, commercial services such as The Source, Gamemaster, and Micronet offer all sorts of services. Messages ("electronic mail") can be left for other subscribers to the service; owners of a particular piece of equipment can put programs and notes in a file that is available to other owners; stock market quotations and news wire information can be accessed; and programs that will run on your computer can be obtained by phone. The charges for these commercial time share services are billed to the user on an hourly basis. The cost is only a few dollars per hour, but that can add up over a month. In addition to the features mentioned already, time share services usually allow a subscriber to do actual programming in several different languages (e.g. FORTRAN, COBOL, PASCAL, and BASIC), and there is usually some means of storing programs and data on a disk or tape storage device.

There are indications that time sharing computer services are likely to grow dramatically in the coming years, with many new features available to small computer owners. To take advantage of all this you'll need a modem.

Music Synthesizers

Our first experience with computer-based music was a simple little board that had about $2 worth of parts on it. From this crude little board came a tinny but recognizable rendition of "Boogie Woogie Bugle Boy."

Today, computer-generated music is serious business. Many college music departments have added a computer to their assortment of pianos, tubas, and violins. The *Computer Music Journal* is devoted solely to this field.

The minimum hardware, minimum cost, and minimum performance computer music systems are still around. For less than $30 it is possible to play around a bit. These inexpensive systems don't really let you realize the full ability of the computer, though. A sophisticated music system will cost much more, but the difference is worth it if you're serious about music. Our favorite system is the Micro Composer from Micro Music of Normal, Illinois. It is designed specifically for the Apple computer and costs around $220. The price includes a small board that plugs into the Apple, an excellent manual, and a lot of software on disk. The Micro Composer includes an amplifier, and with it you can play high quality, four-voice music through a good quality speaker which you supply. The pitch, rhythm, and timbre of the music can all be controlled and adjusted. In addition, it is possible to compose original music, play it, edit and modify your composition, and then save it on tape or disk for use later. As you compose or play a piece the music appears on a musical staff displayed on the screen. As each note is played it marches off the left side of the screen. Computer music systems have reached an admirable level of quality and sophistication. They can be a source of entertainment, interest, and education for every member of the family.

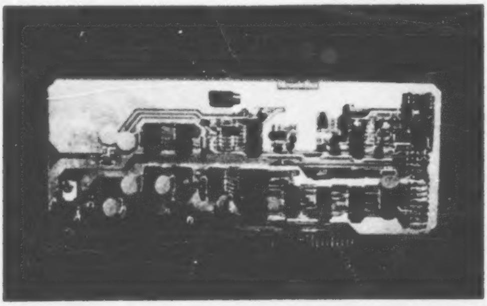
Ham Radio Interfaces

There are several sources of computer software and hardware for amateur radio buffs. We'll describe the product of one supplier in this section. An innovative company called Macrotronics of Turlock, California has created an impressive combination of hardware and software that turns the TRS-80, the PET, or the Exidy Sorcerer computer into a powerful tool for ham radio operators. The S-80 Ham Interface for the Sorcerer is priced at $149. It can teach you Morse code if you don't know it already, but that's just a small part of its job. When the S-80 is attached between the computer and the transceiver it allows the ham operator to tune in a station transmitting Morse code and see the decoded message on the screen. It beats figuring all those dits and dahs out in your head. The S-80 can handle transmission speeds anywhere from 1 to 399 words per minute as well as Teletype-generated messages at 60 to 100 words per minute. The message received can be saved on cassette and read later. The S-80 will also transmit code using the Sorcerer keyboard. In fact, you can type in a message while you're listening to the incoming message. It appears at the bottom of the screen. When you're ready, just hit a key and the message on the screen goes out in Morse code. The S-80 has several more features, but these should be enough to whet your appetite if you're a ham.

Speech Synthesizers and Speech Recognition Boards

Some of the most fascinating capabilities of small computers are their abilities to generate speech and to recognize or understand spoken words. Speech generation is a feature of the Texas Instruments line of computers, but it is also possible on several other computers when a speech synthesizer, such as those based on the Votrax units, is added. Even the best speech synthesizers won't be mistaken for John Travolta, but some of them are very good. A talking computer can be an interesting novelty when speech is added to games, but it can be much more than that in other applications. A blind person, for example, can hear the computer call out the name of each key as it is pressed. In computer-assisted instruction directions and prompts can be spoken rather than printed on the screen, something that is essential when working with students who don't read.

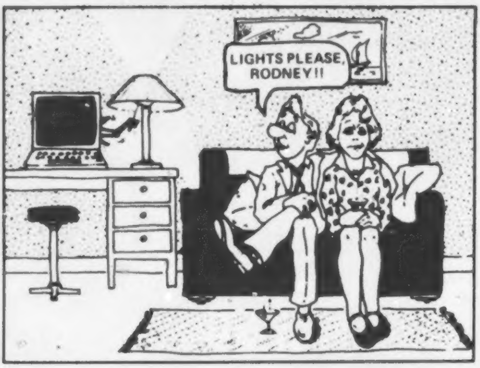
The speech synthesizer sold by Radio Shack for the TRS-80



A speech synthesizer circuit board

is based on the Votrax unit manufactured by Federal Screw Works. It can produce 62 different phonemes which can be combined to create words. Its costs $299 and connects to the computer through a short ribbon cable. It's an interesting and useful accessory.

The opposite of speech synthesis is speech recognition – the ability to recognize different sound patterns. While there are several speech recognition units on the market, the best known is Speechlab from Heuristics. Heuristics offers several models of their product with prices ranging from $189 to $299. The less expensive Model 20 is actually the easiest to learn to use. It must be "trained" to recognize a particular person's voice and a particular set of sounds. The training is accomplished by typing in the words to be learned (up to 32) and then speaking each sound or word plainly when the computer prompts. Once trained, the computer can then identify the words spoken to it. One sample program in the Speechlab manual is a Blackjack game that lets you tell it to "Hit" or "Stand" rather than asking the player to press a key. Another sample program uses speech recognition in an inventory program. The user supplies the name of a part in inventory and the computer prints out information about that part on the screen. Another growing area for speech recognition is in aids to the handicapped. A bedridden individual who has the ability to speak could use a computer to control his environment. The room temperature could be changed, the radio and television controlled, the telephone answered, and so on. Expect some


LIGHTS PLEASE, RODNEY!!

exotic speech recognition equipment for computers in the next few years.

In this chapter we told you about some of the equipment available right now for small computers. If we peek over the horizon to see what may be available in the near future the prospects look fantastic. Whether you have a regular job or a futuristic application in mind, new equipment, improved models, and advanced software will make it easier.

Chapter 11

Where To Find Everything We Didn't Tell You

It is said that an army travels on its stomach. The analogy for computer users might be that their progress is determined by their sources of information. You, of course, are ahead of the game since you had the good taste to read this book. It has provided you with a solid foundation of essential information.

This book, however, is just a beginning. Learning more about computers is a difficult process for two main reasons. First, the field is changing rapidly. In all likelihood a number of things in this book will be incorrect by the time you read it. Many changes will have occurred since we began writing. For example, the technology of data storage has advanced so quickly that many books written just a year or two ago do not deal with important topics such as hard disk systems, backup storage options, and quad density or double sided disk drives.

A second problem that plagues us in this field is the wide range of information available and the technical nature of it. You cannot become an expert in every area of knowledge about small computers. It is just not possible. There is too much to know, it changes too quickly, and it is not possible to keep all the knowledge fresh by using it every day. The day of the all-around computer user who could write programs, build and repair equipment, and use the computer to do a job is just about over. Most users want to treat their computers just like they do a typewriter or any other office machine. They learn to operate it and leave the repair, maintenance, and improvements to someone else.

Since a computer can be programmed to do many different jobs it can be profitable to learn something about computer languages, different programs that can be bought and used on your computer, and different types of accessories that are available. It will pay off, though, to spend some time thinking through just what you want to learn. Is hardware and equipment your bag? Is learning to write your own software an interest? Do you want to concentrate on one particular computer and learn everything you can about it? Is there one special area such as word processing, accounting, statistics, or computer-assisted instruction that interests you? The answers to questions such as these will help determine the next step in your learning program. This chapter will also help by describing some of the typical sources of information on small computers.

Bibliographies and Directories

Without reservation we would recommend that you buy the *Periodical Guide for Computerists*. It is a yearly guide published by E. Berg Publications, P.O. Box 1151, Bothell, Wa., 98011. The cost is very reasonable, and you get a bibliographic guide to all the material that appeared in the major computer magazines and journals during the year. If, for example, you're considering buying a particular computer system, the *Guide* will tell you where to find reviews of the equipment. Looking for a program to do a particular job? The *Guide* can help by providing information on programs published in magazines and tell you where to find reviews of commercial software too.

There are also several directories of computer programs for particular computers. One of the best buys on the market today is a 99-cent softbound book from Radio Shack entitled *Applications Software Sourcebook*. It contains descriptions of hundreds of programs for the Radio Shack computers. Some of the programs are sold by Radio Shack, but most are available from individuals or software companies. The magazine *Micro* publishes a similar list of software for computers using the 6502 microprocessor chip (e.g. Apple, KIM, PET, Atari, SYM, AIM, and Ohio Scientific Computers). The 6502 software list is a continuing feature of the magazine, which means you'll have to buy the magazine, including back issues, to get an up-to-date list. For some the list will be worth the price of the magazine (available from Micro INK Inc., Chelmsford, MA 01824).

Book Publishers

It is true that some of the big name or general purpose publishing houses are involved in producing books for small-computer users. Prentice Hall, for example, has a number of books about microcomputers, but most of them are written for professionals with degrees in electrical engineering or computer science. John Wiley & Sons is an exception to the general rule. Wiley has a series of paperbacks that are specifically directed to the beginner, with many of them written by well-known authors in the small-computing field.

For most of the big general purpose publishers, however, books about small computers are a sideline. Their main interest is somewhere else. There are six book publishers, though, who have committed a large amount of their corporate energy to publishing material for small-computer users. Our publisher, dilithium Press, (P. O. Box 606, Beaverton, OR 97075) has a list of over 80 books, all of them on some aspect of small computing. We may be a little prejudiced, but we believe dilithium has the best line of small-computer books on the market. The difficulty level of dilithium's books ranges from introductory to advanced, with an emphasis on the beginning and intermediate levels. The dilithium catalog, *Brain Food*, is one free publication you will find very useful. Call 800-547-1842 to be put on the mailing list. dilithium also publishes computer programs for several popular computers; they are listed in the catalog too.

Another important publisher is Hayden Book Company (50 Essex Street, Rochelle Park, New Jersey 07662). Hayden publishes a variety of books in the electronics field, but they have been particularly active in the small-computer field. They are also one of the more active distributors of computer programs. You will see racks of Hayden software in many computer stores. A similar company that hams and television repairmen will be familiar with is Howard W. Sams Publishers (4300 W. 62nd Street, Indianapolis, Indiana 46206). While there are some introductory books in the Sams catalog, many are written for the professional or the serious hobbyist who has considerable interest and background in electronics. The Sams books also tend to emphasize circuit design and construction rather than general computer use or software. If you're interested in building your own computer or in designing or building equipment that can be used with your computer then the Sams catalog will be of great interest.

There are three other publishers, Osborne, Sybex, and Scelbi, which should also be mentioned. Adam Osborne is a well-known writer and consultant who started his own publishing house several years ago. Recently the company became part of the McGraw-Hill empire and is now Osborne/McGraw-Hill (630 Bancroft Way, Berkeley, California 94710). The original line of Osborne books were heavy tomes that took great patience and effort (a Ph.D. didn't hurt either) to get through. They were read mainly by a sophisticated audience of engineers and experienced design specialists who were interested in using the new technology in equipment they designed or built. More recently, Osborne has begun to publish some introductory books that may be of interest to you. In addition, the company has published several books which consist of listings of programs you can type into your computer and run. Two other publishers Sybex, Inc. 2344 Sixth St., Berkeley, Ca., 94710 and Scelbi Publishers, 20 Hurlbut St., Elmwood, CT 06110 have a line of books that is similar to those of Osborne.

Several of the magazines that will be mentioned in later sections also publish books, particularly *Byte* and *Creative Computing*. The management of *Kilobaud* also runs Instant Software, a publishing house with a very nice catalog of computer programs for sale.

Before moving on to other sources of information we should note that most of the major computer magazines carry reviews of books. A thorough review can sometimes be invaluable in helping you decide whether a book is worth its price to you.

Magazines

We have divided the magazines into three categories according to the specificity of their coverage. Every computer user will probably find it profitable to subscribe to at least one or two, and many will subscribe to several. Magazines are excellent sources of current, up-to-date information.

General Electronics Magazines. Magazines in this category are not devoted totally to computers, but they have enough articles on computers to make them worthwhile.

Radio-Electronics – This magazine tries to cover many aspects of the electronics field with frequent articles on audio equipment, radio, television (including satellite reception), and video recorders. Most issues include a few "build this" articles. In recent years *Radio-Electronics* has published many good articles on computers. Several of the articles are introductory in nature and up to date. A few have described ways of building small computers or computer accessories. Since this magazine is on most newsstands we suggest you browse through each issue and decide whether it has enough relevant computer information to warrant buying it.

Popular Electronics – Like *Radio-Electronics*, this one also tries to cover the waterfront. The mix of articles in the two magazines is similar. It would be difficult to choose between them since both often have useful information. One thing that might tilt things in favor of *Popular Electronics*, if you're considering subscribing to one or the other, is the fact that two of the regular columns in it are about computers. "Computer Sources" by Leslie Solomon presents a brief description of new computer equipment and software. "Computer Bits" by Carl Warren generally consists of a page or two of commentary about some aspect of small computer use. Warren may also discuss new equipment or software and may even include a program or two for one of the more popular machines. The contruction projects described in each issue of *Popular Electronics* are often computer-related as well. Like *Radio-Electronics*, *Popular Electronics* is available at most newsstands.

Major Computer Magazines. The periodicals covered in this section are all aimed at the small-computer market. They may vary somewhat in their emphases, but they all try to cover general developments in the field. A well-stocked computer store will generally carry most if not all these magazines in stock.

Byte – One of the first, *Byte*, has become a sophisticated small-computer magazine with articles of interest primarily to the initiated. There are articles on programming languages, many articles that tell you how to build computer equipment, and several regular columns on a variety of topics from education to computer languages. Most beginners will find *Byte* tough sledding. New computer users who already have a strong electronics background, however, may find the construction articles both understandable and interesting. In fact, many consider the series of construction articles written by Steve Ciarcia to be one of *Byte*'s greatest contributions to the literature.

Almost 70% of *Byte*'s readers are engineers, scientists, or computer programmers and 68% of the readership has at least a bachelor's degree. *Byte* is now a McGraw Hill magazine that is slick, edited well, and aimed at intermediate and advanced small-computer users.

Microcomputing—Wayne Green started *Byte* several years ago and lost control of it through a series of conflicts. Green has always been opinionated, outspoken, and somewhat gruff at times. He has also frequently been right on the button with his predictions and forecasts. He started *Microcomputing* after *Byte* slipped from his editorial grasp. Originally named *Kilobaud*, it became *KILOBAUD Microcomputing*, then *kilobaud MICROCOMPUTING*. Eventually it became just *Microcomputing*. Green also started a couple of ham radio magazines and has another computer magazine in his stable. His monthly editorial ("Publisher's Remarks") is always interesting to read even if you don't agree with him.

Compared to *Byte*, *Microcomputing* is less cerebral. There are fewer conceptual articles and more "here's how-to-do-it" articles. A recent issue, for example, told you how to turn the Exidy Sorcerer computer into a "dumb terminal" for a time sharing system, how to build several pieces of computer test equipment, and how to add inexpensive extra memory to the Cosmac Elf computer. The same issue carried general articles on computers in the office, reviews of several new computers, reviews of commercial software packages, and several more construction articles. Since *Microcomputing* always has articles about specific computers, there will probably be many articles in each issue that do not interest you. The ones on the particular computer you own, however, may be worth far more than the cost of the magazine. The articles in *Microcomputing* range from introductory to very advanced, and the topics vary considerably. There are product reviews, how-to-build-it pieces, articles on different types of computer languages, and actual programs you can type into your computer and run. Few people will be intensively interested in every article, but there are likely to be at least ten or so in each issue of *Microcomputing* that make the issue worth its price. That's especially true if you have interests in both software and hardware.

Interface Age—The cover of this magazine says "computing for the home and business." That is, indeed, where *Interface Age* seems to concentrate. Unlike *Microcomputing* it rarely publishes an article on how to build something. Instead it concentrates on articles of interest to the person who wants to use a computer to do a job. Like *Byte, Interface Age* publishes concept or idea articles. *IA* also has several important columns on computers in education, legal issues, and mathematics and computers.

Interface Age is probably the magazine most suitable for the small-business person and the home computer user with software but not hardware interests. By this we mean the person may be interested in programming the computer but not in building equipment or repairing sick systems. *IA* has articles on programming, it regularly publishes programs readers can use in their own computers, and it has some of the best reviews published. *IA* publishes reviews on computers, computer systems, accessory boards, and software packages. *IA* also has a large "New Products Directory" section that includes both hardware and software for small computers. It has to be considered one of the better magazines—the best, in fact, for its target audience.

Popular Computing—The editors of *Byte* correctly surmised that the level of most articles appearing in *Byte* is well beyond the comprehension of most beginners. Not wanting to ignore the needs of a large segment of the market, they created *Popular Computing*. It is a mixture of tutorial articles, product reviews, and application descriptions that seem particularly suited to the needs and interests of relatively inexperienced computer users. Most *Popular Computing* articles can be understood by readers with little or no background. That one attribute makes *Popular Computing* the choice for most people reading this book. That is not to say the articles talk down to the reader; they just don't assume you have a Ph.D. in computer science.

Personal Computing—This magazine covers some of the same territory as *Interface Age*. While the format of *Personal Com-*

puting is a bit less formal or businesslike, it regularly publishes articles of interest to the small-business person. There will probably be more reviews of expensive business computers and software in *Interface Age* and more "fun" programs in *Personal Computing*. A recent issue of *PC*, for example, included a BASIC program to print price lists for products with a "two-step distribution channel" and another BASIC program that let you be Alice searching for the Rabbit with the mean Queen and dippy Mad Hatter interfering with your efforts. *PC* also publishes many programs for home and school applications (e.g. a grading program for teachers and a program to balance your checkbook). Reviews of new products and listings of programs you can type in and use are *PC*'s strong points. *Personal Computing* also has regular columns on computer chess, computer bridge, and computer games. It has, in fact, been criticized because it devotes so much space to these topics. Perhaps some issues were heavy on chess, but *Personal Computing* has always published articles of general interest.

Creative Computing—This magazine is a lot like *Personal Computing*. It carries articles that can be understood by the beginner and the intermediate. Most issues are a mixture of product reviews, tutorial articles, and programs. *Creative Computing* has excellent reviews of computers and computer accessories. It does a good job of reviewing software packages as well. Another strong point of *Creative Computing* is the sophisticated software provided. It has published hundreds of computer games, simulations, and applications programs. Some of their software is just plain fun, but many *Creative Computing* programs are educational (e.g. a program to teach children to solve math word problems) or applications (e.g. a program to help department heads manage their budgets). Whereas *Personal Computing* has special columns on chess and bridge, *Creative Computing* has monthly columns on the PET, Apple, TRS-80, and Atari computers. These columns are usually only a page or two, but they are extremely helpful to owners of those systems.

Infoworld—*Infoworld* is different from any of the publications mentioned thus far. To begin with, it is published 24 times a year, and it is in a newspaper format. *Infoworld* concentrates on two types of information—news and product reviews. The news includes anything from a blow-by-blow account of corporate mergers, suits, and countersuits, to in-depth pieces on new areas of application (e.g. computers and satellite communication channels) and descriptions of new products. *Infoworld* is in a niche no other publication serves. Perhaps it's stretching a bit to call it the Wall Street Journal of small computing, but there are similarities.

If you're not interested in "news" this publication may still be of interest. It carries some of the most critical reviews in the field. If a new and expensive piece of software is poorly written, if it doesn't do what it claims to do, the *Infoworld* reviewers say so. They don't mince words. Letters from dissatisfied customers are also published. The letters they published on one manufacturer told such a tale of horror that many potential buyers changed their minds. To be fair, *Infoworld* also publishes rebuttal letters from the companies involved, but all that butting and rebutting frequently generates quite a bit of heat. If you're likely to be buying a lot of expensive software or if you regularly purchase small-computer equipment for your business, a subscription to *Infoworld* is well worth its price.

Special-Purpose Computer Magazines. All of the magazines described thus far are to a greater or lesser extent "general" interest magazines. As the field has grown, however, many smaller publications aimed at a particular audience have appeared. Some of these publications concentrate on a particular area of application such as education or small businesses. Others concentrate on one computer or a particular type of computers. The publications in this category tend to come and go at an alarming rate so be sure the one you're interested in is still publishing before sending in your subscription check.

Applications Magazines. There are two well-established magazines which deal with a particular application. *Small Business Computers* (33 Watchung Plaza, Montclair, New Jersey 07042) publishes articles of interest to the business community. *SBC* does not publish programs that can be used in business. Instead it offers tutorial articles (e.g. a guide to small-business computing), articles on special topics (e.g. disk equipment for businesses), and guides to equipment and software packages used by the business community (e.g. current software for mailing lists and labels).

The other popular special-purpose magazine is *The Computing Teacher* (^{c}/o Computing Center, EOSC, LaGrande, Ore., 98750) It publishes articles on the use of computers at all educational levels. Some programs, usually written in BASIC, are published but the emphasis is on articles written by educators which describe the way they use computers or their views on the current educational computing scene.

Product-Oriented Publications

A few of the computer manufacturers publish newsletters or small magazines about their product. Radio Shack, for example, will send the *TRS-80 Microcomputer News* free of charge to anyone who requests it. The price is right and the little newsletter often contains very useful information as well as product announcements from Radio Shack. North Star Computers also has an excellent newsletter devoted to their line, and Apple Computers produces *Apple* which is a combination magazine and catalog of Apple computer products.

In addition to the in-house publications mentioned above there are several other magazines that deal with only one type of computer. A new magazine titled *S-100 Microsystems* (P.O. Box 789, Morristown, New Jersey 07960) covers all the computers which use the S-100 bus. (The S-100 bus is a particular pattern of connecting each of the elements in a computer together. Today it is used mainly by the more expensive, business-oriented computers.)

The magazine *Micro* is subtitled "The 6502 Journal." *Micro* (Chelmsford, Massachusetts 01824) contains articles on the computers that use the 6502 microprocessor chip (Apple, PET, Atari, SYM, KIM, AIM, and Ohio Scientific). It publishes a mixture of product reviews, construction articles, and programs written in BASIC and 6502 assembly language. *Micro* has grown from a brief offset newsletter with an amateurish appearance to a slick typeset magazine filled with useful information for owners of 6502 computers. Many of the articles assume the reader is an intermediate or advanced computer user however.

Nibble (Box 325, Lincoln, Massachusetts 01773) is a lot like *Micro* but concentrates only on the Apple computer. It carries beginners articles but also has many construction articles and program listings for the intermediate and advanced Apple user.

Newsletters for the Apple, the Pet, the Exidy Sorcerer, RCA's VIP and RCA's Studio II computer (no longer manufactured) are published by Aresco (Box 1142, Columbia, Maryland 21044).

We will end this section with a discussion of the magazines that concentrate on the TRS-80 computers from Radio Shack. This one computer probably has more written about it than the next ten most popular systems. Here are the most popular of the TRS-80-oriented publications:

80 Microcomputing—This is Wayne Green's new baby. Its format is a lot like *Microcomputing* which was described earlier. Every article, however, is relevant to owners of Radio Shack computers. Perhaps the slickest of the special-purpose magazines, it publishes many articles of general interest which are slanted to the TRS-80. Virtually every major accessory available for the TRS-80 and much of the commercial software for it is reviewed in *80 Microcomputing*. Many BASIC and machine language programs are also published, as well as beginning and intermediate articles on using the computer in business, home, and educational settings. The magazine also publishes many construction articles. Whether you like Wayne Green or not, his *80 Microcomputing* should be a required purchase if you own a TRS-80.

Apple Orchard—If you own an Apple computer or if you are thinking of buying one, then you will want to subscribe to this magazine. Published four times a year by the International Apple Corps (a consortium of Apple user groups). It is loaded with useful information about Apple computers. You will find both software and hardware articles. There are also lots of other useful articles and listings. For instance, most issues carry a partial list of Apple dealers. It is available from the International Apple Corps, P.O.Box 1493, Beaverton, OR 97075. Subscriptions are $10 per year.

80-US—This sharp publication is produced by 80-Northwest Publishing Company (3838 South Warner Street, Tacoma, Washington 98409). It publishes many programs for the TRS-80 wirtten in both BASIC and machine language. *80-US* also carries many reviews of accessories and software for the TRS-80 and publishes beginning and intermediate articles on topics of general interest. *80-US* is well worth its price.

TRS-80 Computing and *TRS-80 Bulletin*—These two newsletters are published by Computer Information Exchange

(P.O.Box 158, San Louis Rey, California 92068). Both use a newspaper format and contain large amounts of advertising. The *Bulletin* is available free at many computer stores while *TRS-80 Computing* is a monthly subscription publication. It contains software and equipment reviews and articles on building accessories and modifying your computer.

If you've arrived at this point by reading all the chapters that preceded it, you're at least a bona fide "beginning computer user." We assumed you were at or near a zero level of knowledge when you began reading. Now you're at the upper end of the "beginner" range. After another book or two mixed with a few subscriptions to some good magazines, you'll fast become an intermediate computer user. Perhaps in a few years we'll even see articles or a book about computers written by you. On the other hand, maybe we won't. Writing books and articles isn't all that much fun. Using computers for fun, for profit, or for learning is a lot more interesting to most people. We hope you join the millions of people who are becoming informed computer users and that you find computers as enjoyable to work with as we do.

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